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	Page
Coal Mining...	289
German Scheming in China	290
Metropolitan Munitions	290
Copper	291
An A.E.G. Development	291
The Trend of Electrical Development	292
Trade Entente after the War	293
German Engineers in China: A Glance at their Methods, by Prof. C. A. Middleton-Smith	294
Correspondence—	
Wrinkles on the Operation of Alternators	295
Extraction of Oil from Feed Water	295
Units from Refuse	295
London Electrical Trades Arbitration	296
New Battery Signalling Bell	296
Legal...	296
New Electrical Devices, Fittings and Plant (*illus.*)	297
America and Argentine Trade	298
Trade Statistics of Egypt	299
War Items	300
Reviews	302
The Russian Electrochemical Industry	303
Business Notes	304
Notes	308
City Notes	310
Stocks and Shares	311
Share List of Electrical Companies	312
Market Quotations	312
Metal Market—Fluctuations in August...	313
Encouraging the use of Electric Motor Vehicles	313
Progress in High-Frequency Alternators (*illus.*)	314
Third-Rail Construction on the L. & Y. Manchester—Bury Line (*illus.*)	315
Turbine Pumps for Colliery Pumping	316
Oil Circuit Breakers: Notes on Arc Phenomena and Tendencies in Design (*illus.*)	317
Foreign and Colonial Tariffs on Electrical Goods	320
New Patents Applied for, 1915	320
Abstracts of Published Specifications	320
Contractors' Column ... ... Advertisement page xviii	

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COAL MINING.

To the man in the street, a coal-owner is a very-much-to-be-envied person, and without doubt there are very many lucky individuals drawing handsome incomes from coal royalties, the coal having been discovered on their property by accident, or by some other person or persons risking their money in boring operations to find it. The owner of the coal does nothing, risks nothing, to obtain the coal, but he may, and often does, put certain restrictions and conditions on those who do take the risks. In effect the coal-owner really and truly "gets something for nothing." We agree with the man in the street that it does not seem right—to the collier working at the coal face it seems a "damnable wrong"—but it was ever characteristic of the British love of justice, that whatever it *allowed* to be, became a *right* to the individual, and while most of us may bemoan the fate that made us into common individuals instead of *coal-owners*, we have the good sense to bow to the force of circumstances and not to begrudge the coal-owner his good luck. There are other coal-owners, however, who bought the rights to the coal royalty, and they are, therefore, in quite a different category seeing that they have invested capital, and we suppose even the miner would admit the right of such an owner to charge a royalty. He (the miner) would admit the right, but possibly only on condition that he could have a satisfactory answer to the Socialist's poser, "Where did he get his capital?"

The colliery owner, however, is in a very different position. He does not own the coal—he works it. He risks his capital in sinking shafts, putting up plant, buying wagons, and laying railways, to enable him to get at the coal, bring it to the surface, and deliver it to the consumer. In this respect colliery owning is not different from any other industry, except that perhaps there is a good deal more risk, and there is certain to come a day when the yield is ended. A new mine in a new coalfield will attract much capital, and for the first years may give big returns—but there is sure to come a time when costs increase and the yield becomes less. There may, however, still be much valuable coal to be obtained—and in the days in which we are now living coal is as good as gold—but is it to be left, and finally lost to the nation, simply because the colliery owners, owing to the increased cost in obtaining it, cannot sell it at a profit? The old coalfields are always in competition with the new coalfields; the old nearly worked out colliery is struggling against the competition of the new up-to-date pit, fitted with its fine modern plant. The owners of the old pit would like to make improvements to reduce their costs—their own capital, however, is locked up in the old pit, and they cannot obtain new capital. Who, in fact, is going to put good money into an old concern? Only a fool.

The miner works at the face of the coal usually on a piece rate of so much per ton. Much of the work he does

might be done with the aid of machinery—but this involves capital, which the old mines cannot obtain. It matters little to the miner to-day whether the pit he works at is an old or a new one; years ago, in the days when the miner was an individual, it did matter. There is, however, an end to the days of the individual, and now the individual miner has become merged in a mass called a Union. The Union has "leaders," who do what the mass tells them to do. These leaders become Members of Parliament, and finally get the ear of the Government; and the Government calls them fine fellows, and gives them all they ask for. They ask for an eight hours' day; they get it. They ask for a minimum wage; they get it. The wealthy owners, with a prospect of 2s. a ton profit can pay it, the poor owners, with a profit of 3d. per ton—How can they pay it? Only by raising the price of coal, which allows the poor owner to exist and the wealthy owners to do better still. The miners see reports of big dividends; small ones have, of course, absolutely no interest for them. They again instruct the leaders to ask the Government to give them a still higher wage, for now it is becoming the custom, not for miners and owners to settle their differences between them, but for the miners to appeal to the Government to force the owners to give them their demands.

War breaks out, every ounce of coal is wanted, thousands of miners are in the trenches risking their lives for their country, yet we have the miserable and disgraceful spectacle of miners at home seizing the opportunity of the country's peril to extort greater demands from the coal-owners. We are in agreement with the *Times*, that unless we are to suppose—and it is unthinkable—that these men actually desire to help the enemy, to sacrifice their fellow-countrymen and fellow-workmen who are fighting for them and the whole national cause, we must conclude that they do not know what they are doing in stopping the supply of steam coal at this time. Though great numbers of the more patriotic ones have gone, we cannot accept the ludicrous argument that this in itself proves the patriotism of those who have stopped at home. As our contemporary aptly puts it: "If somebody is drowning, and A takes off his coat and jumps into the water, his conduct hardly proves the courage of B, who sticks resolutely to the bank, comfortably seated on A's coat. Nor, when he refuses to give A a hand, would the excuse that he is busy keeping his coat warm for him carry much weight. People would say that the first thing is to get A out of the water, because if he is drowned the coat is not much good to him whether warm or cold. We cannot, therefore, admit the plea that men at home are doing their duty to those who are fighting by keeping up their trade position, when the process involves jeopardizing their lives." They want not only an increase in wages, but a new standard which shall embrace the higher rate and shall stand for all time. In other words, they want something for nothing. It matters nothing to them what trade may be like after the war, it matters nothing to them how the poorer collieries may suffer. They expect that the Government will fix matters in such a way that those wages can, and will be, paid. Surely if ever Ministers bought a rod to their own backs, certain Ministers of the late Government did so, and they are now experiencing difficulties which they themselves set up. What will they do in regard to the Welsh miners? What else can they do except settle the strike by enforcing the owners to grant the demands? Anybody can settle strikes on these lines. But what of the future? There lies a problem.

From the chief Mines Inspectors' report just issued we learn that the output of coal was reduced by 21,766,080 tons for the year 1914. We also learn that the number of persons ordinarily employed between January and July was 1,133,746, or an increase of 5,856 over 1913; but on the last pay-day in December of 1914 the number of persons employed had fallen by 152,482 (most of whom have joined H.M. Forces) to 981,264.

The country is passing through a terrible crisis in its history, and the handling of the coal trade by the Government is rendering it still more difficult, but we can only hope it will manage to steer clear of involving the owners in such a mesh that many of them at the end of the war may find it necessary to close down their mines, which is a contingency, however much it may be deplored, that is very likely to happen.

German Scheming in China.

A FORTNIGHT ago we published an article from one of our contributors in China on the electrical trade position in that country—vast in area, vast in population, and vast in possibilities. In the main the writer (Mr. G. R. Archdeacon) dealt with the Chinese character, showing how the British trader must needs shape his policy and his methods in order to be successful in winning his way with the Chinese purchaser. To-day we are enabled to publish a contribution from the same quarter of the globe from another esteemed contributor—Prof. C. A. Middleton-Smith, of Hong-Kong University. This writer, whose previous articles, written as the result of observations made from his own peculiar coign of vantage, are well remembered by British firms, touches upon a different aspect of the trade situation. Mr. Archdeacon described Germany as being for the moment "removed from active operations" there, and doubtless that had been his own experience; but he also alluded to their loud acclamations of joy indicating that they were in no doubt as to the future success of their past ventures. Prof. Middleton-Smith to-day shows how great has been the activity of German agents in doing everything possible to undermine British engineering interests there. Though he also describes Germany as "our late trade rivals," he shows that "Germans free to move about the Far East are working as industriously and as infamously against Great Britain as are those in the Fatherland." The "Gospel of Hate" still has its bases there, though Tsing-tao has been lost to Germany for ever. Years before the war we published information from English authorities in China on the methods of our rivals, so that our firms might see the pressing necessity for strong and combined action to counteract German influence. It was the need for such action that led us to make our appeals for the Hong-Kong University equipment, which appeals helped to elicit so excellent a response from British manufacturers. Prof. Middleton-Smith was himself criticised several years ago for speaking the unpalatable truth in regard to the situation, but his attitude, and that of other contributors and of ourselves, is more than justified in revelations that have since been made. Our daily newspapers have contained a good deal on such matters lately, and it is satisfactory to learn of the measures that Britishers on the spot are taking to prevent German traders gaining commercial success, either in the present or the future, from their intrigue. They will require all the support that firms at Home can give them. We commend the Professor's article to the attention of those who want information regarding the necessity of being prepared for what the future has in store in foreign markets. Reference to German after-the-war trade schemes is also made in our "War Items" to-day.

Metropolitan Munitions.

BETWEEN two and three months ago, as we announced in our pages at the time, a movement was set on foot for the purpose of utilising all available workshop and other suitable accommodation in the metropolitan area for the production of munitions of war. Since then a large amount of necessary work has been done to that end, and we learn from the authorities that the organisation is now

complete, and it lies to the credit of the numerous eminent engineers and manufacturers who have concerned themselves with the matter that already, as we are informed, most excellent work is being done; to use Mr. Lloyd George's words, "the machine is beginning to move." Professional and working engineers alike, as well as those with works' accommodation in their possession or control, will read with interest the announcement concerning the matter that appears in our "War Items" to-day. The metropolitan area has been divided up into 10 sections and a district manager has been appointed with whom are associated an assistant and a munitions engineer. We believe that the electrical profession and industry have been as eager as any class of men or any industry to place themselves, their qualifications, and their specialised facilities, at the full disposal of their country. In some cases they have been disappointed because they appeared not to be needed, but both in the metropolis as well as in the provinces electricity supply "chiefs" have been conspicuously in demand for responsible offices in connection with munitions. Among the metropolitan district managers are to be found some of our leading electricity supply men whose names are most familiar to our readers. We may rest assured that these gentlemen will be found to be well able to make efficient use of the works and factory accommodation and plant which their investigations have shown to be available; also that they will, because of their knowledge of engineering life and training, be able to avoid the needless turning down of offers of competent service. The notice to which we allude indicates that those who have any information to impart which may assist the Committee in its operations may be assured that their help will be very acceptable, also that offers of premises, tools, plant, or services, &c., will be welcomed. Eager as has already been the desire of the metropolitan engineering world to assist, we believe that as the result of this announcement many more offers will be forthcoming from those who want to be turning their technical experience to good account in fighting the enemy.

Copper. Since last writing the copper market has been in a particularly interesting mood, a continued succession of declines in the price of standard copper due to a succession of depressing incidents in the Eastern war region having been succeeded by a violent reaction which added about £6 a ton to the value of warrant copper within a couple of days. The excitement recalled some of the pre-war market days, and considering the critical times through which we are passing, matters almost assumed a normal appearance of activity. There is no doubt that leading interests had been waiting for some break in the monotonous regularity of depressing war news, and that they seized with avidity upon the very modest and temporary turn in the tide intimated by the Riga dispatches to start a bold buying movement in standard copper, recognising that without this their position as big and growing holders of refined would become untenable. A buying movement was certainly overdue judging from all external appearances, and this has been undoubtedly forced on by the sustained upward rush of prices. At the same time the more cautious spirits are of opinion that the movement can only be a temporary one, inasmuch as the conclusion is not to be resisted that the American production of fine copper is now proceeding at a rate distinctly in excess of the consumption. Not sufficient importance has ever been attached to the isolation of Germany from the world's markets. Under recent pre-war conditions, Germany was so far the largest individual consumer of American copper in Europe, and it is absolutely impossible for record output across the Atlantic to be absorbed so long as the German market is closed to United States copper producers. The sequence of events in the London market is merely a facsimile of what has occurred from time to time in past years, when for some reason or other producers have found themselves saddled with the growing accumulation, and when means had to be found to disperse holdings which were becoming weighty. If there is no large admitted surplus in America, it is probably either because considerable quantities of copper have been secretly stored on German account, possibly with the intention of embarrassing the Entente Powers, or with the object of providing a stock of copper immediately available for transference to Germany when the war ends. In either event, the cause matters little, so long as the fact remains. New buying has, of course, been stimulated, and to this extent the object of those who have been pulling the wires in the standard copper market has been attained.

An A.E.G. Development. The announcement that the Berlin A.E.G. proposes to assume definite control of the Berlin Electricity Works Co. can scarcely have come as a surprise, having regard to the more than friendly relations which have always existed between the two companies, although astonishment is manifested at the particular time chosen for proceeding with the scheme when it could have been easily undertaken in an earlier period of peace. The supply company was created by the A.E.G. about 30 years ago, and the company had almost a monopoly in the German capital—we say had advisedly, because the company's undertaking is to be taken over by the municipal council on October 1st as at present arranged. Not only was it established by the A.E.G., but the latter had the right of subscribing at par value for one half of the capital increases carried out by the supply company at any time, and it also enjoyed the privilege of being the sole manufacturing contractor for the machinery and plant required in the course of the development of the works over a long period of years. What these advantages have represented in money must be left to conjecture; certainly they must have implied hundreds of thousands of pounds, if not millions, in the course of years. A further factor in the situation has been the concentration of the management of both companies in the same hands, the A.E.G. having received a fixed sum for conducting the business of the supply company. It is now proposed to offer an interchange of ordinary shares whereby one A.E.G. share of £150 nominal would be exchanged for one of £200 nominal of the supply company; and the former intends to increase its share capital by £1,800,000 to £9,550,000, in order to carry the operation into effect. The preference shares of £1,000,000, which have been issued by the B.E.W., will not be affected by the transaction. It is quite possible that the absorption by the Berlin municipal council of the undertaking of the supply company may have exercised some influence in inducing the A.E.G. to strengthen its control over the other company, the continued existence of which, however, was foreseen and assured some years ago by the investment of capital in a number of supply works, and more recently by the acquisition of extensive lignite mines near Bitterfeld. Let us hear what the A.E.G. has to say on the matter. According to a report issued after a recent board meeting, the general situation places before the company the problem of providing compensation for the possibility of a transitory limitation of export activity by means of an increase and extension of its manufacturing branches, and economic generating stations occupy the first rank in connection with such developments. The lignite mines in the vicinity of Bitterfeld of the B.E.W. are intended for this purpose, and the extent of the property has now been enlarged. The report does not specify what work is in contemplation, but it is understood that the output of electrical current, which was originally intended to be transmitted to Berlin, will be utilised in regard to the manufacture of nitrates, both for explosives and for fertilisers, the production of electrolytic copper, &c. An interchange of shares as now projected will relieve the B.E.W. from certain risks in respect to those undertakings, but the A.E.G. feels ready and sufficiently strong to undertake those risks. We thus find the A.E.G. launching upon a fresh undertaking to provide, as it is amusing to read, compensation for the possibility of a transitory limitation of export activity. It would, perhaps, be more correct to say compensation for the certainty of a permanent restriction in the company's exports to the allied countries, even after the conclusion of the war.

THE TREND OF ELECTRICAL DEVELOPMENT.

An interesting presidential address was recently delivered before the American Institute of Electrical Engineers, by Mr. Paul M. Lincoln, on the occasion of the recent Deer Park Convention. He reviews the present position of electrical plant as regards efficiency, and discusses the possible directions of future progress; the following is a summary of his remarks:—

In the matter of efficiency, it has always been recognised that electrical apparatus is in a class by itself. Mechanical energy can be converted into electrical by a generator, or *vice versâ*, by a motor at an efficiency ranging up to as high as 97 per cent., or even more in the most favourable cases; it is safe to say that the average efficiency of conversion of mechanical energy into electrical by generators or electrical energy into mechanical by motors, including all sizes under actual operating conditions, will reach 90 per cent. Owing to the fact that the size of the average electrical generator is much greater than that of the average motor, and that it is possible to operate the generator at higher average loads than in the case of the motor, it must be apparent that the average efficiency for converting mechanical energy into electrical is higher than the reconversion of this electrical energy back into mechanical. The average generator efficiency is undoubtedly well above 90 per cent., while it is doubtful if the average motor reaches so high a figure. Our ability to convert mechanical energy into electrical, or *vice versâ*, has reached so high a value, that even if we could obtain perfection itself, we could add only a matter of 10 per cent. to what we have already accomplished.

The efficiencies of some of our larger transformers, for instance, exceed 99 per cent. The rotary converter, in which alternating current is changed into direct, attains efficiencies approaching 98 per cent. It is evident that perfection itself could not add greatly to existing performances, and hence nothing revolutionary may be expected along this line in the future.

When we come to consider the prime mover, we find a marvellous improvement in recent years. Taking first the water-wheel; the early attempts to develop power at Niagara Falls constitute a significant commentary upon the status of the water-wheel at that time (the late 60's and the early 70's). Of 215-ft. head these earliest wheels used only some 15 or 20 ft. for some of the least progressive, and from there up to possibly 40 or 50 ft. for the more progressive. To-day, water-wheels have no limit in head except that imposed by the strength of available materials, and efficiencies ranging up to 90 per cent. are expected as matters of course. Improvements in water-wheel design will, of course, continue, but perfection itself would add but a matter of 10 per cent. to the best of our modern practice, and not exceed 20 to 25 per cent. addition to the worst. No startling or record-breaking developments need be expected along these lines so long as the law of conversion of energy holds good.

In thermo-dynamic engines, too, the last few years have seen some marvellous improvements; the turbine has enabled us to attain efficiencies in thermo-dynamic conversion that were out of the question with the reciprocating engine of Watt. In the thermo-dynamic conversion the law of conservation of energy takes a peculiar form. If the heat contained in the coal is used to heat a fluid used in a thermo-dynamic engine, the maximum mechanical energy that can be taken from that engine can bear no greater a ratio to the total heat imparted by the fuel to the fluid, than the actual range of temperature used in the engine does to the maximum absolute temperature of the fluid as it enters the engine. Some of the best of our modern steam turbines have attained to as high as 75 per cent.—or possibly a little more—of this "Rankine cycle efficiency." In these most perfect engines, therefore, perfection itself would not add more than 25 per cent. or such a matter. It is only with prime movers of the largest size and most modern design and construction that so close an approach to the ideal can be attained. As capacity is reduced it becomes rapidly more and more difficult to attain the higher degrees of economy in thermo-dynamic machines. This must always remain one of the potent factors in the economics of power supply; it is, and undoubtedly always will be, one of the fundamental reasons why central station supply of electric service must prevail as against isolated plant supply for the same service. The central station can, of course, use units which are very large in comparison, and can be worked at much higher average loads than must necessarily be the case with an isolated plant.

One means that has been suggested to improve the efficiency of the thermo-dynamic engine, is to increase the temperature range through which the working fluid is used. The only two ways to extend this temperature range when using steam are to increase the super-heat or increase the pressure. Increasing the super-heat over the best modern practice does not promise results commensurate with the expenditure of heat to obtain this super-heat, since increasing the temperature at one end of the heat cycle simply involves a loss in the efficiency at the other end. There is a rather definite limit to superheating of steam, beyond which it is useless to go. Increasing the steam pressure does promise results, and it is probable that the tendencies for the future will be toward these higher steam pressures.

Another promising method of increasing temperature range is that, to which attention has been called during the last year or two by Mr. W. L. R. Emmet, of Schenectady, of using mercury as the working fluid in a heat engine for temperature ranges above those available with steam. After working the mercury through a given temperature range, the heat remaining in the mercury is transferred to water, and the steam thus made available is again worked through a lower temperature range. The advantages of this are that the steam cycle is in practically all respects the same as in standard steam turbine practice, and the mercury cycle is closely similar to the steam. Additional energy is made available from the same amount of initial heat due to the greater temperature range obtainable by the use of the mercury. The main disadvantage is the poisonous nature of mercury vapour and the difficulty of absolutely preventing its leakage at the high pressures and temperatures of the mercury boiler. These practical difficulties make it too early to predict whether or not this method will work out as a feasible solution of the thermo-dynamic engine problem. However, it can be said that, without some such method or device, the future is unlikely to bring any revolutionary improvements in thermo-dynamic engines over the best of modern practice.

In the matter of size and capacity of generating units it can safely be said that this will hereafter be fixed by the conditions to be met and not by any inherent limitation in our ability to produce units of any desired outputs. We now have units of 30,000-kw. capacity in service and still larger ones projected, and no limitations of design or material appear of such a nature as to place a stop to further progress along the same line.

In June, 1898, Mr. A. E. Kennelly, gave an inaugural address, in which he pointed out that "in 1884 a 50-kw. dynamo was considered a large machine, while a 100-kw. Edison steam dynamo was justly called a 'jumbo.' At present the largest size of generator built or building is of 4,600-kw. capacity." In the 14 years from 1884 to 1898 the maximum size of generator, therefore, increased 46-fold, while in the 17 years since that time, the increase has only been about seven-fold. While the increase in capacity, therefore, has been a marked one, the rate of increase has not been so rapid during the last 17 years as it was in the previous 14 years, a result which naturally might have been anticipated. The future will undoubtedly continue to produce larger and larger capacity machines, the limit as to size being dictated by plant capacity and economic considerations and not by any inability to produce the larger sizes.

In the matter of selling price, Kennelly mentioned that "the price of dynamos in 1882 was about 20 cents per watt of output, while dynamos of similar running speed for comparatively small sizes without switchboards now cost about 2 cents per watt." The speed and size of these units is not mentioned, but it may be said in comparison that, nowadays, prices are frequently quoted below ½ cent per watt. In this respect again the improvement in the

last 17 years has not been so marked as it was in the 14 years previous; we are approaching a saturation point in this respect.

The two fundamental costs of electrical apparatus are those of labour and material. Economies in the use of labour will undoubtedly take place by the introduction of new methods of scientific management, &c., but these need not be expected to be revolutionary in character so far as cost of apparatus is concerned. The tendency of the labour item will unquestionably be toward appreciation rather than depreciation.

In regard to the item of material, modern design has approached very close to the physical limits of available materials. With higher permeability, making available greater flux densities, the cost of electrical apparatus might be considerably reduced; but it is highly improbable that improvement will be of such a revolutionary character as to cause any sweeping change in the cost of electrical apparatus.

The hysteresis and eddy current losses that take place in irons and steels that are subjected to varying magnetic fluxes is another of the limits encountered in the design of electrical machines. Our modern transformer steels in the matters of losses and iron ageing qualities show a vast improvement over those formerly available. Unfortunately these improvements have so far been accompanied by a decrease in permeability which is highly objectionable in rotating machinery. Unquestionably, further improvements will be made, but will probably make no revolutionary change in the costs of electrical apparatus.

The conductivity of the copper of commerce is within an extremely small percentage of that of pure copper, and we cannot expect to obtain a higher conductivity in copper than that of purity. There remains, of course, the possibility of using some metal other than copper, but there is apparently no metal that even approaches the space and cost characteristic of copper that makes it so essential to the construction of electrical apparatus. Aluminium is a competitor only when the volume of the conductor is not an essential element in design, as in transmission lines and the like.

(*To be concluded.*)

TRADE ENTENTE AFTER THE WAR.

[COMMUNICATED.]

For some considerable time past the question of mutually forming a Trade Entente among the Allies against Germany, after the war, has been very widely discussed from variously divergent standpoints. The proposition has undoubtedly much to commend it, but it is also beset with many serious objections, which probably even the patriotic sentiment of the moment is not capable of entirely removing. Past experience in regard to experiments of a similar nature have proved beyond all dispute that, although sentiment may be all very well in its right place, it cannot at any time be allowed to interfere with the recognised and time-proven laws governing the commercial system.

Too much importance can very easily be attached to the question of the boycotting of German goods by the Allies after the war is over. The experiment, for such it would inevitably have to be considered, would most probably find itself at the very outset in direct opposition to the laws of sound commercial trading. The laws which govern the commercial system are as immutable and dispassionate as those which govern the universe. The purchase of the best goods in the cheapest market is the foundation basis of all successful trading. Any other system which, by imposing artificial restrictions such as boycotting, seeks to evade this unalterable fact, is certain to defeat its own end.

There are may trades, and branches of trades, in which the Germans, from various advantages, geographical as well as traditional, are best fitted to render the highest service, not only to themselves and their neighbours, but to the whole world at large. We in this country likewise enjoy corresponding advantages not possible to the Germans, as, for example, the adaptability of the Lancashire climate to cotton-spinning, and the production of the best steam coal from Wales. Despite the sustained efforts of the Germans to make themselves independent of cotton goods from Lancashire, the exports from this country in this section, and the large exports sent direct from here on account of Germany, have maintained a steady level, and will doubtless continue to do so in the future, for the reasons just referred to.

On the other hand, there are commodities made in Germany in which other countries have never seriously attempted to compete. To do so in the future would necessitate, in many cases, the entire basic reconstruction of not only the commercial but the social system as well.

The case of the toy-maker furnishes an interesting example. No doubt most readers will have noticed the predominance of crude and half-finished toys in the shops at the present time, especially at the seaside towns. A very cursory examination of the articles is all that is required to act as a prelude to putting them back again on the stall and walking on. These are mostly samples of British manufacture. In Germany toy-making is a tradition, and has become bred in the bone of the peasant. For generation after generation the same families have made toys, from early childhood to old age. With them use has become second nature. The livelihood it brings to the rustic peasant, small as it may be, is certain and seldom fluctuates. This system is one that has gradually evolved, not over a period of a few decades, but over a period of a century or more. So perfect has it become in course of time that it is enabled to show how even a small body of rustic peasants in an out-of-the-way hamlet can produce a commodity cheaper than, and superior to, the products of the modern town factory, with all its scientific and up-to-date organisation and labour-saving devices.

In other directions also the boycotting of German goods after the war would prove a most unsound procedure to the commercial interests of this country. In the electrical engineering sections the Germans have built up a colossal system of specialisation, which has demonstrated its economical soundness in almost every possible way. Instead of producing a highly-complex machine complete, with almost every part made in the same works, as do many of the British firms, the German system of specialising confines the entire resources of one given firm to the production of one given part. The result is that many of the leading British machine-makers have been able to obtain certain machine parts from Germany cheaper and better made than from any other source.

If these sources of supply are stopped after the war, it will mean that British machine-makers will, while this system of specialisation is being built up and extended in this country, either have to put in inferior parts in their machines, or pay extortionate prices, and be put to endless inconvenience.

This building-up question, by a natural transition, leads to perhaps the most important aspect of the matter. Who is going to do the pioneer work, and undertake the enormous responsibilities in removing the dead wood and undergrowth to make clear the way for future enterprise? The individual trader was content to do this in the past, when other pioneers were doing the same elsewhere, with perhaps very little, if any, start of him. But to expect him in these times, on the uncertain offer of a temporary boycott of an outside competitor's goods, to attempt this prodigious task, confronted as he is with the knowledge of a highly scientific and almost perfect system attained elsewhere, is neither sound in theory nor reasonable in policy.

There are, doubtless, many trades in which the Germans have acquired a monopoly, apart altogether from geographical or traditional considerations, in which the Allies could make themselves independent in the course of time by mutually supporting each other wherever possible. Unless this mutual support, however, is based from the first upon the sound economic principles governing the laws of fair and legitimate trading, the experiment is almost bound to prove of no commercial value. Patriotic sentiment, and even Entente Cordiales, when brought into contact

with the calm platonic laws of trade, quickly lose their identity.

The mutual interests of the Allies will, to our mind, be best served in the future, not by placing artificial restrictions against the German commercial system in so far as it affects them severally or collectively, but by their making themselves more independent of it by improving and strengthening their own. Moreover, in order to show their entire disgust of German barbarism, it would be necessary for the Allies to entirely dispense with everything associated with German origin. It is impossible to wholly effect this result, inasmuch as Germany has become by course of time a vital part of the international trade system, and cannot be cut away from it without mutilating the whole.

Even now, much as we do not care to realise the fact, there is hardly an important commercial house in London or Manchester, or in Berlin or Hamburg, that is not in some measure bound up with the interests, direct and indirect, of each other. To dispense with Germany from the international trade system, it would be necessary to efface her entirely as a commercial nation. This cannot be done, nor is it desirable that it should be attempted.

What is desirable, and even essential, is that something of the same excellent co-operation of the State with the individual, as is enjoyed by the German trader in his country, be likewise enjoyed by the British and French traders in theirs. If the State has held itself aloof from the interests and demands of its trading system, as it undoubtedly has done very largely in this country, it is not very likely to prove a success in negotiating a mutual system of trade reciprocity with other countries, whether they happen to be allies in war or not.

In this country the commercial democracy, which comprises the recognised authorities of each trade, has little or no sympathy with the official ornaments of State which are supposed to represent the commercial interests of the nation. While the accepted authorities of the variously important industries in this country resolutely refuse, and with good reason, to have anything to do with Government offices, or even to recognise their authority to speak on behalf of the national trade policy, so long will they remain incoherent to other friendly nations which are prepared to negotiate with us.

France has no more notion how best to approach us on the question of a Trade Entente after the war than the country most alien to our sympathies. The Government trade officials in this country are equally unfortunately placed, in that their utter inability to correctly gauge the opinion of the leading trades' authorities enforces them to sit tight rather than to make a move and come to grief. So much as has yet been done towards framing a suitable trade policy of mutual reciprocity of interests after the war, is due to the foresight and enterprise of the commercial leaders themselves in England and France, and not to the official system of either country.

When all has been said and written, however, on the subject of a Trade Entente among the Allies after the war, the probabilities are that nothing of any material difference will accrue in this direction at any future period whatever, apart from the time-proven policy in vogue prior to the war. The problem of German trade influence, like every problem that is associated with such a colossal question as the setting up of artificial barriers and restrictions against the cold dispassionate laws ruling throughout the entire commercial system, however patriotic the impulse prompting a remedy may have been, must, after all, be left to find its correct position in the universal trade system by the weight of other considerations in which it is inseparably bound up.

Swedish Electrical Exports.—There was a large increase in the exports of electrical machinery from Sweden during the six months ending with June last, the official returns showing that they attained a value of £143,635, as compared with only £97,368 in the corresponding half of 1914. On the other hand, the exports of telephone apparatus showed a marked decline—from £200,405 to £118,998.

GERMAN ENGINEERS IN CHINA: A GLANCE AT THEIR METHODS.

By Prof. C. A. MIDDLETON SMITH, M.Sc.

Eighteen months before the war commenced, the writer was taken to task for stating that the Germans were doing everything possible to undermine British engineering interests in China. The carefully-considered words were subjected to severe criticism at that time. If any Englishman now made a reverse statement, he would, justly enough, be written down as either extremely ignorant or hopelessly insane.

We are all of us, to-day, in possession of facts which two and a-half years ago, were known only to a few. Indeed, no one then quite understood the problem which time has shown up so clearly. There were so many different factors. The diplomatists knew a great deal then—engineers have discovered these facts by a laborious perusal of official papers and published speeches. Business people have been able to explain things which, without a war, would have been of little interest to people not in their own line of business, and the publication of which, indeed, might have injured their own careers.

Enemy Firms.—In the Far East certain information about German business methods has been gained in rather a curious fashion. In that little island Colony in South China, which has had such a romantic history of progress and development, until it has become one of the largest ports (if not, as is often claimed, actually *the* largest port) in the whole world, the Germans also have thriven and flourished under the protection of the Union Jack. The German club in Hong-Kong bears witness to the fact. It is now used as a barracks for the Volunteer defence forces of the Colony. Those Britishers, whose peculiar prejudice against things Teutonic in pre-war days prevented them from accepting the hospitality of members of the club, now have ample opportunity of seeing this centre of "Kultur"; for they rest therein between guards at the internment camp, where the late occupants of the Club Germania now reside. Also, Britishers are now "liquidating" the German businesses. Curious methods are being discovered.

The mention of the club reminds one of the outlook of the Germans in the Far East during the past 10 or 15 years. In Hong-Kong there are practically only three clubs. The largest is the Hong-Kong Club, which was, until recently, frequented by Europeans of all nationalities. There is the Institution of Engineers and Shipbuilders, which is much more of a club than the engineering Institutions in London. There were many German members of the Institution before the war. At a meeting held in this club the writer pointed out the truth, somewhat unpalatable to some of the members, that the unscrupulous commercial methods of the Germans in the Far East were not regarded with complacency by all Britishers, either in the Colony or at "home." Several British members frankly disliked any allusion to such topics, and said so. They have since generously congratulated the writer that there are no German members during his year in office as President of the Institution. It is, of course, almost certain that there never will be any such members in this generation.

Eligibility to these two clubs was not sufficient. These insane German fire-eaters must have their own Club Germania. The thing itself was a thinly-veiled insult to that spirit of generosity which offered all Europeans membership of the other clubs in a British Colony. No other nationality was guilty of such an action.

Li Hung Chang's Impressions.—Most of the readers of this journal will still remember Li Hung Chang's famous tour to Europe. Bismarck unburdened his soul to the astute Celestial. He spoke a great deal about England. "Bluster and bluff" were his expressions. He told the experienced Li that China was making a great mistake by supposing that England would remain in her then proud position. By word, deed and suggestion the German in the Far East has continued the unscrupulous policy of Bismarck. Unfortunately, some of the Orientals have been more gullible than the wily Li.

After the war broke out, the German engineering firms continued to use Hong-Kong as a base for their operations. A disreputable orgie at the Club Germania, in celebration of the fall of Antwerp, forced the hands of the authorities. Those Germans who did not, while yet there was time, leave for Shanghai, Tientsin, or other places in China, are now "interned."

The German Method.—In the West there are commissions. In the East there is "squeeze." There such commissions are moral or immoral, according as to whether they are open or secret. The Celestial mind differs very much indeed from that of the Britisher in many ways. It is probable that there have been certain commercial transactions between men of our own nationality and the Chinese which do not altogether redound to our credit. But, on the whole, the children of Far Cathay trust us more than any other nation. All of the native officials are not corrupt. It is a significant fact that the public men in China, with the best reputation for honesty, are not pro-German.

The methods of our late trade rivals were quite simple. Suppose the Chinese customer wished to purchase a dynamo. He would make inquiries and obtain prices. He would then inform the various competitors that the lowest price was, let us say, $1,500. The German firm would promptly revise their estimate to $1,300, and would supply him with a machine that would do the output required on the overload only. If the customer were a Government official he would have much "squeeze" from the job; the article sold would be, in some way or other, adulterated to pay for the "squeeze."

It is to be hoped that details of the methods of German firms in the Far East will be made public at some suitable time. Many British firms are now the official liquidators of these businesses in Hong-Kong. They have access to the books. It is rumoured that they can learn very little which will assist them to increase their own business by clean dealings.

Trading with the Enemy.—At long last, after 11 months of war, we have the Proclamation about trading with the enemy in China. If it be true, as it has been suggested in the Orient, that it is possible for German firms to reconstitute themselves, so that their headquarters are in, let us say, Shanghai and not Berlin, and so escape the penalties of the Proclamation, it seems a pity that this simple method of evasion was not anticipated.

The war cannot last for ever, and the Germans free to move about the Far East are working as industriously and as infamously against Great Britain as those in their Fatherland. They are spending large sums of money in subsidising the Chinese newspapers. They are organising and bribing and lying as actively as they did before the war. They have lost Tsingtau; but they have bases in Shanghai, Tientsin and other ports, where the Gospel of Hate against Britain flourishes.

They will fail in China, as they will fail in Europe. But for many years they will cause us anxiety out here. They will make efforts more desperate than ever to tap the enormous mineral wealth of this part of the world. They will attempt to use Hong-Kong as a base, but it is to be sincerely hoped that legislation will prevent them doing that.

From 1912 to 1914 the German Government spent large sums of money in China, mostly on behalf of work which would benefit their engineering interests. In the light of recent events we might hastily conclude that it has been all wasted. It is true that the millions spent at Tsingtau are a dead loss from Germany's point of view, although they will assist the other Powers to develop the Province of Shantung. It seems impossible that this nation which has alternately insulted and deceived the Chinese can ever obtain respect from the Celestial. The German people have "lost face." They have lost vast sums of money. But, despite these things, they continue, and after the war is over they will continue to plot and scheme against the influence of Great Britain in China.

It is true that at present many of the large engineering schemes out here are in abeyance. The Hankow concession was arranged soon after the war commenced. £10 000,000 sterling had been promised from a wealthy London firm. Fortunately, the chief engineer of the scheme is a Britisher. As the scheme progresses about 15 British assistants and a great deal of British machinery will be required. The London firm cannot, at present, export the gold, but it is certain that the Hankow development scheme will progress when the war is over. It seems also extremely probable that the prodigious wastage of metals in Europe will lead to the very desirable development of China's mineral wealth.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Wrinkles on the Operation of Alternators.

I have read Mr. Pausey's "Wrinkles on the Operation of Alternators" with much interest having encountered similar difficulties myself, viz, the absence of power-factor and frequency meters.

The traction station to which I refer is now somewhat out of date, and is equipped with B.T.H. multipolar alternators driven by compound vertical engines. To shut down an alternator running in parallel we give the signal to the driver, who begins to shut off steam whilst the switchman weakens the field to no-load excitation. How would Mr. Pausey suggest regulating the fields of two alternators in parallel when the only guide is an ammeter in the field circuit of each machine, and when weights are often placed on the governor of the smaller machine? The traditional method seems to be to synchronise the incoming machine at the normal bus-bar voltage, then to reduce the field of the machine already on the bars until the resultant voltage is the normal running voltage. Is this correct?

Again, a Westinghouse rotary of the fixed ratio type whose power-factor meter indicates ·95 lagging under all conditions of load except reverse current, runs with a constant excitation of 3·2 amps., but when a second alternator is switched in, the rule-of-thumb method is to reduce the field to about 2·8 amps. Are there any logical grounds for this?

Switchman.

Extraction of Oil from Feed Water.

In an article in this week's REVIEW on "The Use and Abuse of Oils on Mining Plant," by T. C. Thomsen, B.Sc., on page 285, this statement appears:—"Electrical treatment of the feed water will extract every trace of oil." I should be pleased if, through your "Correspondence" columns, the exact method referred to could be given, and the quantity of current necessary per thousand gallons of water treated. The firm I am connected with use the hot water from the jet condenser, in connection with the main engine, for the washing of cloth. We have no oil separator, and treat the water by passing it through a coke filter. All the oil is not extracted, however, and I should welcome some method of eliminating the remaining traces of oil, such as suggested by the author of the above article. I may add that the present arrangement does not lend itself to the introduction of an oil separator.

Cloth.

August 30th, 1915.

Units from Refuse.

In reply to Mr. Morgan, I should again like to make it clear about the point "so strongly raised" by me, namely, the setting of the boiler directly above the combustion chamber. In the first place, for the last three years I have actually worked a similar arrangement (although not quite such a good one as that proposed) on our peak load in order to save refuse, as in this way I can get an evaporation of 4½ to 5 lb. of water per pound of refuse, as against 4 lb. with our new destructor, and 2·5 lb. with our old one (which was done away with).

Although the above requires no further argument, I see nothing whatever in Mr. Morgan's contentions. With the boiler directly above the combustion chamber:—

1. You can still get an equally large thermal storage system of red-hot brickwork, with the further advantage that this stored heat is always evaporating water to greater advantage, and the point that Mr. Morgan mentions about the boiler tubes tending to cool the brickwork more quickly is exactly what one wants for the purpose of raising steam. It is always an advantage in favour of any destructor to be able to get rid of your heat usefully.
2. The proper combustion of the fumes depends not only upon the temperature of this chamber but the size of it, and the combustion chamber can be made of ample size under a large water-tube boiler.
3. It is easier to raise steam, and, what is more important in a central station, to get it up when it has fallen on load.
4. The dust can be provided for just as easily as with the usual *wasteful* arrangement of having a combustion chamber which does not act directly upon the boiler tubes.

I am glad Mr. Morgan invites destructor engineers to take part in this controversy. Messrs. Meldrum installed our grates for

burning refuse directly under the boilers, and Messrs. Heenan and Froude our last destructor. The Meldrum grate can beat the Heenan destructor (excellent as it is) for steam raising, and the Heenan destructor has the advantage of the Meldrum grates in other ways, such as dust catching and getting rid of a greater quantity of refuse. Therefore, as stated in my article, a combination of the two methods (namely, with the boiler fixed above the combustion-chamber), would have been the perfect method had the original arrangement of our plant allowed us to carry this out, and, whatever theory says against this method, I must be pardoned for still believing what I have seen every day for the last three years.

A. J. Abraham, *General Manager.*

Aberdare Electricity Works,
August 27th, 1915.

London Electrical Trades Arbitration.

The District Secretary of the London District Electrical Trades Union has circularised the Electrical Press, stating that Sir David Harrel, the Arbitrator, has awarded members of that Union an advance of ¾d. per hour, which, coupled with the 1d. advance obtained by the Union last year, constitutes an increase of 1¾d. per hour, in a little over 15 months, for electrical wiremen and fitters in the metropolitan district.

This statement is extremely misleading, and avoids the main facts, the intention being, no doubt, to claim a series of victories over the employers, who, however, stand in the happy position of knowing that the 1d. advance was offered by the masters, and accepted by the Union after the strike, which, from the men's point of view, was not a brilliant achievement. In addition to this, an advance of 1½d. per hour was demanded by the men, and refused. However, the masters agreed to arbitration, realising that an increase of wages was justified during the present national crisis, with the result that the Arbitrator awarded half the amount demanded, the award reading as follows :—

"August 11th, 1915.

"I hereby award that the existing rate shall be raised from 10½d. to 11½d. per hour, with *pro rata* advances to electricians, labourers, and assistants, such advanced rate to come into operation as from the beginning of the first pay day following the date hereof, and the advance now awarded to be *regarded as war wages, and recognised as due to and dependent on the existence of the abnormal conditions now prevailing, in consequence of the war.*"

The italics are mine.

Although this award applies only to members of the London Union, and, strictly speaking, is limited to such, the members of the London Electrical Masters' Association have decided to apply the increase to all employés, *Union and non-Union*, although no agitation has been apparent among their non-Union employés.

Surely, it cannot be claimed that the award is a triumph for the Union! It would have been better to leave the matter as it was without comment, and it would have remained unchallenged, but for the braggadocio of a "Union" official.

The unfortunate outcome of any concessions by the employers to their workmen, is that the Trade Union officials flatter themselves that they have defeated Capital, whereas the result is but an empty triumph, resulting in constant stress instead of harmony.

In conclusion, it may be said that the award is anything but an advertisement for the Electrical Trades Union. The officials controlling same would be well advised to keep in the background, and avoid basking in the limelight during the present troublous times.

W. Ellerd Styles.

London, W., *August 30th*, 1915.

New Battery Signalling Bell.

From the "Notes" column of the Electrical Review for August 13th I see that a paper on the above subject was read at a meeting of Mining and Mechanical Engineers at Newcastle-on-Tyne.

I should like to point out that I have fitted several bells with condensers and connected them across the contacts. This idea is working excellently, and reduces the spark on the contacts to a minimum.

I have had these bells (fitted as described above) in use for some time on surface work at Askern Colliery, and find not only that the spark is reduced but that there is much less trouble in keeping the contacts clean, thus ensuring a good signal.

Arthur H. Marsh.

Askern Colliery, near Doncaster,
August 28th, 1915.

Car Starting and Lighting Equipments in the States.—According to some figures compiled by Mr. G. Brewer Griffin, of the Westinghouse Co., U.S.A., the total number of motor-cars produced in the United States during the past 12 calendar months was 611,695, and of this number 261,860 were fitted with electric starting and lighting equipments.

LEGAL.

Electric Pocket Lamp Prosecution.

In the City of London Court, on August 25th, before his Honour Judge Rentoul, K.C., Mr. E B. Holmes, special constable, of Hackney, sought to recover £1 8s. 8d. against Mr. Percy Patterson, electrician, trading as the Electric Supply Store, 77, Fore Street, for damages for injury caused to his clothing owing to a defective flash lamp purchased from him.

Plaintiff's solicitor said the plaintiff bought a pocket electric lamp of the defendant on his guarantee that the plaintiff could put it in his pocket without it leaking. Plaintiff wanted it for use during his duties as a special constable. When he put it in his pocket the lamp leaked owing to the accumulator being defective. He took it back, and a new accumulator was given to him, but that was worse than the first. Sulphuric acid from the lamp leaked. Plaintiff's clothes were burnt.

Defendant told the Court that the lamp was absolutely safe if the plaintiff used it properly and carefully,

Judge Rentoul thought that the bare fact that the defendant had sold the lamp was a guarantee that it was fit for use. An electric pocket lamp was not fit for use if it leaked.

Defendant said that plaintiff handled it carelessly. He did not sell the accumulator as being unspillable. They were all made with a percentage of sulphuric acid in them, and it was impossible to make an accumulator otherwise. No maker would guarantee such a thing. If so, the whole electrical industry would be stopped.

Plaintiff added that when defendant told him that the lamp could not leak, he showed him that it was packed with gauze which would absorb the acid, and so prevent it coming out.

The Defendant assured the Judge that an accumulator could not be made that would not leak. There was nothing on the lamp to say that the acid was unspillable.

Judge Rentoul did not think the lamp ought to leak. He did not think anybody would buy an electric flash lamp if he knew it was going to leak and burn holes in his clothes. It seemed extraordinary to him that a man should be asked to take an electric lamp to use in his service as a special constable and for it to leak.

Plaintiff further said that when the lamp was attached to the terminals and started burning it caused the acid to bubble. The chemical action caused that, and that was what caused it to escape.

Defendant said he could demonstrate in Court that that was not so, and that although he did his utmost to stop lamps from leaking and to make them as safe as possible, he could not undertake any responsibility. No manufacturer of electric pocket lamps would dream of doing anything of the sort. He produced a lamp which was put on the Judge's desk and lighted, and he declared that it would not bubble over as the plaintiff said had happened with his lamp. The lamp was put on the Bench and remained there until the end of the case without leaking.

Plaintiff suggested that if the lamp was put on its side it would probably leak.

Judge Rentoul said the lamp had not leaked, but the defendant was responsible for leakage unless he could prove that electric pocket lamps could not be made without leaking.

Defendant: Every accumulator has loose acid in it, and if you turn it upside down it will leak. I could make it leak if I pressed it. This lamp has been treated carelessly. This is a very important question, and the whole industry is looking to the decision in this case. This is a very vital case because all accumulator making, which is a vast industry, will be stopped if your decision is against me pending an appeal.

Judge Rentoul: I hope not.

Defendant: We dare not sell another. There must have been a pint of acid spilled over the plaintiff's clothes to have done this damage, and there was not more than a thimbleful of weak acid in the accumulator that he had.

Plaintiff pointed out that a few spots of sulphuric acid would be quite sufficient to burn the clothes in the manner shown. The acid had even eaten through the metal of the case. The defendant contended that it was a got up case.

Judge Rentoul deprecated the use of such observations. At the same time he did not think he ought to give a decision without some independent evidence if the chemical or electric lamp industry was so concerned as the defendant suggested.

Defendant: This acid is not dangerous.

Judge Rentoul thought it might be wise to settle the case, and then suggested that expert evidence ought to be called.

Defendant: This is not for carrying about in the pocket but for household use and to put on bicyles. It they are kept upright they will be all right. He paid 5s. 6d. for it. I do not guarantee it to be unleakable.

Plaintiff's solicitor argued that the defendant would be liable for even a latent defect.

Defendant: If you decide against me the case will have to be taken up by the whole industry.

Plaintiff: You said the manufacturers would defend the case, but they are not here. I was told that it would not leak if I turned it upside down.

Defendant: We sell them as moist accumulators.

The Judge suggested that the plaintiff might accept half the amount of his claim, but the defendant said he was either in the right or in the wrong, and that if the decision was against him, pocket electric lamps made in the future would have to be stamped "sold without a guarantee."

The Judge did not think the plaintiff would have bought the lamp if he had thought it would leak. In his view unleakable lamps could be made, and electric pocket lamps ought not to be sold if they leaked. If the electrical trade was affected by the matter he would give leave to appeal against his decision, but he must find for the plaintiff, with costs.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

New G.E.C. Flame-Proof and Water-Tight Bell for Mines.

In the new G.E.C. flame-proof and water-tight trembling bell illustrated in fig. 1, special attention has been given to the design and construction so as to make it comply thoroughly with the Home Office regulations.

The bell action is enclosed in a cast-iron flame-proof case. The lid is bolted to the case, and contact is made between machined flanges 1 in. wide. These are of sufficient heat capacity to cool effectively any hot gases expelled in the event of an internal explosion. The case is water-tight and thoroughly

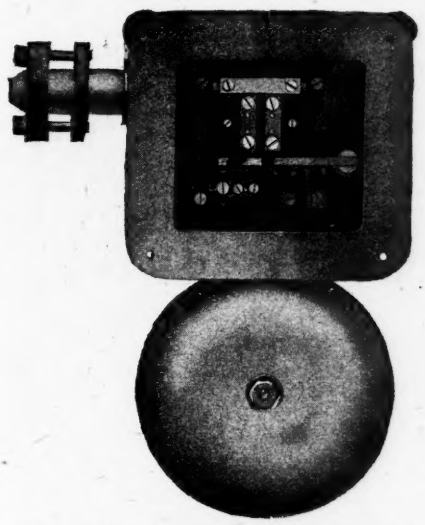


Fig. 1.—G.E.C. Flame-Proof and Water-Tight Mining Bell, with Cover removed.

enamelled to prevent rusting. The internal unoccupied space is kept down to a minimum, so as to limit the amount of explosive gas which might accumulate.

The hammer is connected to the armature by a shaft which passes through a gland, 1 in. long, in the bottom of the case. It is situated under the gong and is thereby afforded additional protection. A flame-proof gland is also fitted to the case. It is designed to take an armoured lead-covered twin cable.

The bell is made with two sizes of gong, 6 in. and 8 in. respectively. The 6-in. bell weighs 14 lb., and requires a pressure of 6 volts across its terminals to work it satisfactorily, while the 8-in. bell weighs 16 lb. and requires 10 volts. The resistance in each case is 25 ohms, and the current taken just under 0·1 ampere.

These bells are made by the General Electric Co., Ltd., 67, Queen Victoria Street, E.C.

Ediswan Silk Shades.

Though it is probable that there will be fewer new lighting schemes undertaken in the coming season owing to the general

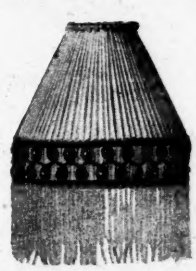


Fig. 2.—Ediswan Lamp Shade.

feeling for "household economy," it is practically certain that in many cases new shades will have to replace those that have seen the previous season through.

The Edison & Swan United Electric Light Co., Ltd., Ponder's End, who, we understand, have been doing exceedingly well in their silk shade department, have sent us a neat little stiff covered booklet of silks, which contains nearly 50 different tints of reds, greens, blues, browns, &c., with a sample attached to

Fig. 3.—Ediswan Lamp Shade.

enable a prospective buyer to test the quality. All shades can be re-covered in a similar fashion to match others, and old pattern shades can be renovated. Illustrations are shown here of some recently executed designs, which are stock lines, but it is also a speciality of this department to make for all individual requirements.

English Electrical Novelties.

Messrs. Ward & Goldstone, of Sampson Works (Salford) Manchester, have recently issued a four-page pamphlet dealing with electric pocket lamps, torches, medical coils, bell and pushes, miniature electric motors and parts for constructing same, lamp refills, dry batteries, and other small technical goods. These originally in great part came from the Continent, but Messrs. Ward & Goldstone are now manufacturing them for themselves.

We illustrate a Sturdee torch fitted with a hood (fig. 4); this is a non-rusting torch, fitted with a refill, which in ordinary use

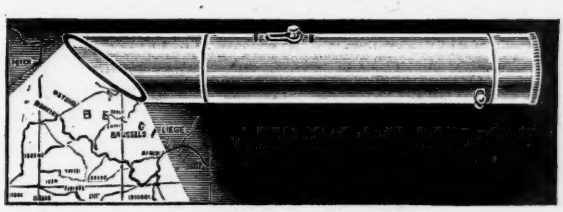


Fig. 4.—Sturdee Torch with Hood.

Fig. 5.—Special Pocket Lamp.

Fig. 6.—Velox Refill.

will give 15 hours' light, and hold up for 12 months without failing. Figs. 5 and 6 illustrate a special pocket lamp, and the Velox pocket lamp refill, which is made specially for export, and will remain in condition in stock for nine or 12 months.

Photographic Meter Records.

The Eastman Kodak Co., of Rochester, N.Y., has introduced a novel meter reader's camera which enables photographic evidence of the state of the consumers' meter dials to be obtained.

The meter reader (or photographer in this case) simply holds the camera opening against the meter dial glass and presses a lever, which automatically opens the shutter for a definite period, and at the same time lights four small battery-operated lamps to illuminate the meter dial.

At each exposure the shutter is locked and cannot be again operated until the film has properly advanced for the next exposure.

By pressing a lever the camera can be used as a lantern in dark

passages. A roll of film provides for 75 exposures, and costs roughly one shilling; two extra rolls can be carried in the camera, allowing a total of 225 exposures.

The film on which the pictures are taken consists of an emulsion on opaque paper, backed with a white coating, which makes details of the developed film show up clearly, reversed right and left, mirror fashion, and the reversed film is read by means of its reflection in a mirror and identified by the customer's name and meter number on the dial. The "Factograf" camera gives an indisputable record, and is especially useful in taking maximum demand readings, where the pointer is set back to zero, thus preventing future reference. These cameras are being employed on several meter routes by the Rochester Railway and Light Co., of N.Y.—*Electrical World.*

"Hemming" Grip Fittings.

The Hemming Conduit Grip, Ltd., of Hatherton Street, Walsall, is introducing a new patent grip fitting which we illustrate in fig. 7. It is claimed that its electrical conductivity is equal to the tube, and it can be used with any type of tube, close joint, or seamless. Undersized tubing can also be used with

Fig. 7.—New Grip Fitting.

equally good results. It will be seen that the grip is obtained by screwing up a specially shaped cotter, the side of which bearing on the tube is serrated and bites into the tube. Unscrewing the nut and tapping the cotter pin, releases the tube. A full selection of conduit fittings is made by the firm in ½-in. to 1½-in. sizes.

Single-Tumbler Double-Pole Switches.

The term single-tumbler double-pole switch is meant to convey that the article in question is a tumbler-action switch for double-pole connection. Thus, instead of the usual coupling together of two separate single-way tumbler switches, we have the combination on one base of ordinary size.

So far as we know, Messrs. A. P. Lundberg & Sons, of 477-489, Liverpool Road, London, N., are the only manufacturers of switches of this kind, and their 10-ampere surface and 5-ampere flush patterns are respectively shown in figs. 8 and 9.

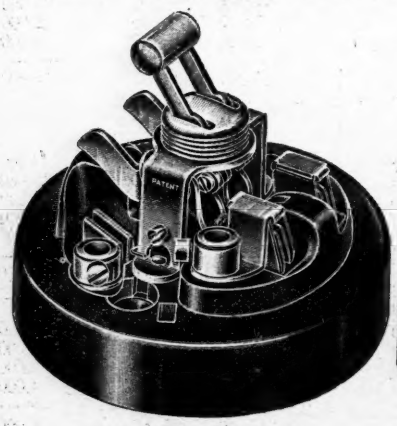


Fig. 8.

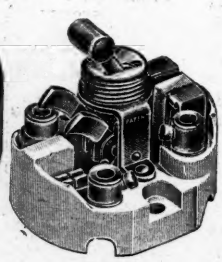


Fig. 9.

Single-tumbler d.p. Switches.

The 5-ampere size is also made for surface work, and various patterns of cover (metal or porcelain) are available, the metal covers for surface work being generally lined inside with fibre.

This type of switch is very largely used on electric heating and cooking apparatus in conjunction with some other type, for varying the number or arrangement of the heating sections in

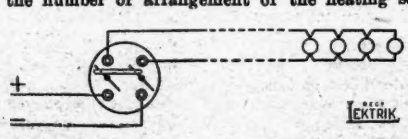


Fig. 10.

circuit. Some of these groupings are as follows:—Double-pole with series-parallel, double-pole with series-parallel and off, double-pole with "Twinob," double-pole with "all-or-part," double-pole with (special switch).

The uses to which these switches can be put in lighting installations is a matter of more general interest, and two such uses are shown in figs. 10 and 11.

When a lamp (or group of lamps) is on an out-of-doors circuit, or in a cellar or other more or less damp place, it is decidedly better, for various reasons, to break the circuit on both poles (as in fig. 10)

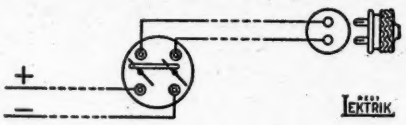


Fig. 11.

than to use a single-way switch. The same arguments apply also to the control of plug-sockets (fig. 11), an additional one being that there is no chance of shock at all if the socket is entirely "dead" when off.

Lelios Lamps.

The A. & A. Electrical Co., Ltd., of 51, Whitcomb Street, W.C., has recently placed on the market the Lelios (patent) lamp shown in fig. 12, in which it will be noted that the filaments are stretched horizontally between flexible supports secured to a rectangular glass frame. The light is distributed downwards,

Fig. 12.—Lelios Lamp.

giving, with the help of a suitable shade, an excellent illumination below the light source.

The lamp is of a type which has proved particularly serviceable for certain purposes, and is made in 10 to 50-c.p. sizes for 25-130 volts; in 16 to 50-c.p. for 140-260 volts; and in 100 to 600-c.p. sizes for all voltages.

The firm also supplies the A. & A. tungsten lamp of the standard pattern, in usual candle-powers and for usual pressures.

AMERICA AND ARGENTINE TRADE.

Argentina is dependent on foreign countries for almost all kinds of manufactures, and, as has been noted previously in the Electrical Review, the American Consular officials in that country have not lost sight of the fact that the conditions in Europe have presented an opportunity to the United States for consolidating her position in that market. The American Consul at Rosario in a recent report points out that, owing to business depression in Argentina, the new interest displayed in American goods failed to result in a corresponding increase of imports from the United States into his district. On the contrary, imports from the United States, as from other countries, fell off considerably during 1914. It may, however, be noted that in several instances Rosario houses have placed orders in the United States which would under ordinary circumstances have gone to Europe. Moreover, many new firms are now in correspondence with American exporters.

American business circles are fully alive to the opportunities for trade expansion in South America. However, in spite of intelligent efforts of numerous commercial organisations in the United States, many individuals are still in the dark as to how the desired end is to be attained. In view of the persistency with which numerous exporters remain true to

the method that consists of advertisements, circulars to prospective customers, and inquiries addressed to Consuls, a repetition of former remarks and recommendations may be pardoned. Furthermore, this matter concerns the individual directly. The individual business man can only make known and urge his needs as respects trade facilities. When these facilities are given, however, whether or not he will reap any benefit from them depends chiefly on himself.

Granted adequate shipping and exchange facilities, the most important factor in the extension of export trade in Argentina is the willingness of the seller to get into some sort of personal relation with the Argentine customers and make indispensable concessions to the latter's methods of doing business. If the market appears likely to be important and permanent, the manufacturer can well afford to make the trip himself. Travelling salesmen should be sent out at regular intervals. If the probable demand does not seem to warrant such expense, articles may be placed in the hands of a commission house or a Rosario agent, although it is, of course, difficult to make satisfactory arrangements for an agency by correspondence. Another practice that may be recommended in such cases is the sending of a traveller by a group of non-competing manufacturers. Exporters should realise that their successful competitors have built up their export trade here through personal effort, and that goods will find a permanent market only in this way. Direct personal relations between buyer and seller will tend to obviate other difficulties often considered inherent in some trade methods, such as unfavourable credit terms and unwillingness to conform to local requirements.

The exporter who knows the standing of the purchaser of his goods will realise the propriety of giving him credit, and not a few travellers who have left their principals with orders to demand cash have prevailed on their firms to grant reasonable credit facilities after they have reported satisfactorily on standing and banking arrangements. In the same way, the writer knows of cases where the personal visit of a factory representative has sufficed to insure the local importer a regular supply of articles specially designed to meet his needs. It is, furthermore, obvious that the establishment of direct personal relations will do away with hundreds of misunderstandings, inevitable under other circumstances and harmful in the highest degree to American trade in general, which can frequently be ascribed to business on a correspondence basis. Orders are undoubtedly secured by correspondence, but such business generally lacks a firm basis and is apt to be taken by the first enterprising competitor who gets into personal touch with the customer.

The outbreak of hostilities in Europe and the current belief that there was a shortage of merchandise in South America gave an unprecedented increment to the steady flow of catalogues, circulars, and letters—often bearing the well-known penalty postage stamp—from American firms to Rosario. Such literature receives little attention. Especially when business is good, importers have no time to wade through catalogues and cannot afford to lose the six or eight months often required to make satisfactory arrangements by letter. Such trade methods are viewed with little favour. The average Rosario importer is a frank critic. If possessed of a kindly feeling toward the United States, he regrets what he considers the ignorance of American exporters. In many instances, however, he attributes the correspondence method of trade extension to the desire of the American manufacturer to get something for nothing. Certain features of American foreign commerce—strict adherence to cash policy, unwillingness to meet local requirements, failure to cultivate personal relations with customers—have created an impression in certain quarters that the American merchant is selfish, inconsiderate, exacting; that he demands the largest profit with the smallest risk, and that, giving no aid, he expects the local importer to do all the work. The attitude of many Rosario merchants towards American trade methods is apparent from the frequency with which they terminate any discussion of the subject by the Spanish proverb: "He who wants to eat fish must be prepared to get wet."

Many exporters seem to be of the opinion that a great volume of new business can be obtained by mailing catalogues and circulars to all consular officers. As respects Rosario this is an error. This does not, however, mean that it is not advisable to have catalogues on file in Consulates, and this practice undoubtedly does result in orders. Furthermore, letters addressed to Consular officers on particular subjects enable them to furnish useful and timely information. The Consular officer cannot, however, replace the traveller. He has not the samples, the necessary technical knowledge, nor the time to press goods on merchants, and he cannot, of course, take orders. His rôle in trade extension is essentially that of a go-between who endeavours to place those who want to sell in communication with those who are prepared to buy. As respects the supply of information, the Consul obtains the most reliable data available, but he cannot in all cases, in spite of a careful study of the situation, report definitely on the saleability of a particular article. A salesman might often succeed in marketing goods when importers have unanimously informed the Consul that there is no demand. The Consular service is a factor in trade expansion, but it must not be assumed that it can relieve thousands of exporters of the necessity of doing just such things as their foreign competitors have had to do.

It not infrequently happens that a firm will prepare a circular to be sent to all Consular officers requesting information, names of dealers, possible agents, etc. Occasionally such a general circular will be received by a Consular officer in a large city where the firm in question has already appointed an exclusive agent. It is obvious that the possible ignorance of the existing agency arrangement on the part of the Consular officer may lead to unpleasantness, and, in extreme cases, to the loss of a good agent. The method of requesting information, and the details that should be given to ensure getting useful information, must vary according to the market to which the request is sent. It not infrequently happens that when the results of such an inquiry are not as satisfactory as the firm might desire, the firm itself is considerably more to blame than the Consul to whom the application was sent.

TRADE STATISTICS OF EGYPT, 1914.

The following statement, showing the imports of electrical and similar goods into Egypt during the year 1914, is taken from the recently issued trade statistics. The figures for 1913 are added for purposes of comparison, and notes of any increases or decreases are given:—

	1913. £E.	1914. £E.	Inc. or dec. £E.
Rails.—			
From Great Britain ...	106,000	8,000	– 98,000
,, Germany	20,000	140,000	+ 120,000
,, Belgium	59,000	18,000	– 41,000
Total	185,000	166,000	– 19,000
Steam engines, including boilers, etc.—			
From Great Britain ...	128,000	85,000	– 43,000
,, Germany	7,000	13,000	+ 6,000
,, Belgium	500	4,000	– 3,500
,, France	8,000	5,000	– 3,000
,, Holland	6,000	1,000	– 5,000
,, Italy	11,000	13,000	+ 2,000
,, Switzerland ...	2,000	—	– 2,000
,, Austria-Hungary ...	20,000	—	– 20,000
Total	183,000	121,000	– 62,000
Electrical machinery.—			
From Great Britain ...	15,000	13,000	– 2,000
,, Germany	8,000	2,000	– 6,000
,, Austria-Hungary ...	3,000	9,000	+ 6,000
,, Belgium	6,000	1,000	– 5,000
,, United States ...	3,000	—	– 3,000
,, France	27,000	2,000	– 25,000
,, Italy	3,000	1,000	– 2,000
,, Other countries ...	1,000	8,000*	+ 7,000
Total	66,000	36,000	– 30,000
Petrol and benzine motors.—			
From Great Britain ...	62,000	74,000	+ 12,000
,, Germany	31,000	21,000	– 10,000
,, Italy	22,000	15,000	– 7,000
,, Switzerland ...	29,000	35,000	+ 6,000
,, Other countries ...	2,000	7,000	+ 5,000
Total	146,000	152,000	+ 6,000
Railway and tramway carriages.—			
From Great Britain ...	2,000	36,000	+ 34,000
,, Germany	5,000	10,000	+ 5,000
,, Austria	21,000	30,000	+ 9,000
,, Belgium	20,000	16,000	– 4,000
Total	48,000	92,000	+ 44,000
Lamps of all kinds.—			
From Great Britain ...	6,000	6,000	—
,, Germany	21,000	14,000	– 7,000
,, Austria	29,000	14,000	– 15,000
,, France	6,000	7,000	+ 1,000
,, Italy	1,000	1,000	—
,, Sweden	7,000	5,000	– 2,000
,, Holland	2,000	1,000	– 1,000
,, Other countries ...	1,000	1,000	—
Total	73,000	49,000	– 24,000
Copper, manufactured.—			
From Great Britain ...	11,000	8,000	– 3,000
,, Germany	20,000	26,000	+ 6,000
,, Belgium	2,600	3,000	+ 400
,, France	17,000	17,000	—
,, Italy	6,000	6,000	—
,, Other countries ...	3,000	2,000	– 1,000
Total	59,600	62,000	+ 2,400

* Switzerland 7,000.

	1913. £E.	1914. £E.	Inc. or dec. £E.
Scientific instruments.—			
From Great Britain ...	20,000	35,000	+ 15,000
,, Germany	21,000	13,000	− 8,000
,, Austria	1,000	8,000	+ 7,000
,, United States ...	2,000	500	− 1,500
,, France	14,000	9,000	− 5,000
,, Italy	1,000	3,000	+ 2,000
,, Switzerland ...	1,000	2,000	+ 1,000
,, Other countries ...	2,000	14,500	+ 12,500
Total	62,000	85,000	+ 23,000
Other machinery (except agricultural).—			
From Great Britain ...	103,000	79,000	− 24,000
,, Germany	36,000	21,000	− 15,000
,, Austria	7,000	2,000	− 5,000
,, Belgium	4,000	6,000	+ 2,000
,, United States ...	30,000	35,000	+ 5,000
,, France	36,000	15,000	− 21,000
,, Italy	5,000	3,000	− 2,000
,, Switzerland ...	9,000	11,000	+ 2,000
,, Turkey	1,000	—	− 1,000
,, Holland	2,000	2,000	—
,, Other countries ...	—	1,000	+ 1,000
Total	233,000	175,000	− 58,000
Copper, hammered, drawn or sheet.—			
From Great Britain ...	96,000	88,000	− 8,000
,, Germany	15,000	15,000	—
,, Belgium	600	2,000	+ 1,400
,, France	1,000	7,000	+ 6,000
,, Other countries ...	400	2,500	+ 2,100
Total	113,000	114,500	+ 1,500
India-rubber and gutta-percha, raw or manufactured.—			
From Great Britain ...	12,000	8,000	− 4,000
,, Germany	15,000	10,000	− 5,000
,, Austria	4,000	2,000	− 2,000
,, France	8,000	5,000	− 3,000
,, Italy	10,000	5,000	− 5,000
,, Switzerland ...	—	500	+ 500
,, Belgium	1,000	1,000	—
,, Other countries ...	2,000	1,500	− 500
Total	52,000	33,000	− 19,000
Electric, telegraphic and telephonic apparatus.—			
From Great Britain ...	46,000	35,000	− 11,000
,, Germany	25,000	13,000	− 12,000
,, Austria	15,000	8,000	− 7,000
,, Belgium	7,500	10,000	+ 2,500
,, United States ...	1,000	500	− 500
,, France	19,000	9,000	− 10,000
,, Italy	3,000	3,000	—
,, Sweden	18,000	5,000	− 13,000
,, Switzerland ...	4,500	2,000	− 2,500
Total	139,000	85,500	− 53,500

£E = £1 0s. 6½d.

WAR ITEMS.

Effects of a Year of War upon American Electrical Industry.—In order to ascertain just how the present trouble in Europe has affected the American electrical industry in various sections of the country, the New York "Electrical World" recently approached a number of prominent central-station officials, manufacturers, jobbers and contractors, requesting their opinions and observations based on their experiences after a year of the war. The central-station industry, while it has gone forward, did not enjoy during the past year the same ratio of increase owing to a combination of depressed business conditions and to the war. Capital for development purposes is not now easy to obtain despite the permanency of the investment and the vast amount of gold hoarded in bank vaults. Throughout the trade many of the manufacturers feel the results of decreased building operation, but yet they are sanguine of good times to come. The contractors and jobbers naturally experienced some setback in business because of stagnant building trade conditions, while, on the other hand, the widening application of electricity and the campaign for the intensive cultivation of customers now being waged by many central-station companies has resulted in increased sales of electrical appliances, so that dealers generally look on present conditions with complacency.

Our contemporary publishes communications received from the heads of some of the largest holding companies in the country bearing on the situation.

Mr. S. Z. Mitchell, of the Electric Bond & Share Co., of New York, says:—"The earning power of the electrical industry, taken as a whole, has been hurt but little by war conditions. However. the uncertainties created by war conditions have somewhat depressed the market value of electrical securities along with all securities generally, other than the so-called 'war stocks.' Naturally these difficulties have adversely affected the ease of permanently financing every line of business. The money markets and the investment or capital markets, now, as always in times of disturbance, have drifted far apart. Money, as exemplified by short-time, well-secured loans, is dirt cheap and is going begging, whereas capital for permanent investment, particularly for new enterprises, is almost unobtainable at any reasonable price. This has naturally had the effect of checking new developments and expansion of old developments, and I do not look for any material improvement in these conditions until the fear of our becoming involved in foreign quarrels is gone, and also until our people can get a better idea as to what our industrial condition will be when the war is over. Many people feel that a great industrial boom in this country will follow the termination of the war. Others think that directly opposite conditions will prevail, particularly if no changes are made in the meanwhile in the tariff. They believe that when the war is concluded European factories will be found practically intact, and the necessity for employment, and particularly the necessity for immediately producing the largest possible factory output in order to meet war taxes, will be so great that European labour and European manufacturers, under the guidance of their respective Governments, will immediately rush production to the utmost and will make wages and commodity prices low enough to overcome all competition in selling goods, and that under these conditions the Europeans are bound to cut under our prices so that we shall be swamped with foreign goods. . . . I am sure that capital will be timid and new developments will be delayed until investors are better assured as to the outcome than is now the case. The advent of so many war orders in a large number of Eastern cities is proving very helpful to the electrical business. The same may be said as to some of the metal-mining industries. On the other hand, business conditions in the lumber and fruit countries of the Pacific Coast are greatly depressed, and nearly all public utilities in that section are suffering accordingly. The same thing applies, but in less degree, to conditions in some of the Southern States."

Mr. H. M. Byllesby, of H. M. Byllesby & Co., of Chicago, writing from the point of view of the local public utility company, says that there has been a very pronounced adverse effect upon the business conditions of the United States due to the war. "In the first place, it has practically stopped all financing on a large scale, and particularly for new enterprises. In sections which have profited directly from war orders or from the crop situation due to the war there is a certain degree of artificial stimulation. In general we find business in the cities and towns in which we operate to be at least dull, in most cases 'marking time,' and in the Puget Sound and Pacific Northwest section to be increasingly stagnant, this latter situation being more or less influenced by the depression in the lumber trade, which is not altogether due to the war, and to a general collapse following over-expansion in that section. . . . In general the war has had a most distressing effect upon business. It has stopped large financing of a permanent nature, and there is, I think, on the part of all responsible people a feeling of very great anxiety and apprehension as to the future of our own country as judged by the portentous events involved in the present European war."

Mr. Samuel T. Bodine, of the United Gas Improvement Co., of Philadelphia, says that should the war continue for another year, and American concerns continue to rush into the manufacture of supplies for the belligerents at phenomenal profits, of which labour is justly claiming a share, he foresees unrest and misunderstanding in other industries. He concludes:—"I cannot but feel that it would be for the common good of Labour and Capital if the concerns which are growing rich on war orders, instead of establishing high wage schedules, which cannot be maintained when business conditions become normal, would arrange with their employés to set aside for labour a percentage of their phenomenal profits, to be divided, say, every three months."

Munitions Manufacture in Australia.—In the "Sydney Morning Herald" of July 5th it was stated that the manufacture of shrapnel shells would probably be in full swing there within a few weeks. An armaments committee, at the head of which is Mr. A. E. Cutler, and which comprises Mr. J. Davis (Director-General of Public Works), Professor Warren, Mr. Lucy (Chief Mechanical Engineer for Railways), Mr. Brain (Chief Electrical Engineer for Railways), and the representatives of the principal engineering firms, have been handling the work pertaining to engineering matters, while the Chamber of Manufactures has been attending to the remaining supplies. The various engineering firms have been circularised as to their possibilities, and the replies have been highly satisfactory. Several well-known gentlemen of high standing have offered their services free. It is expected that, with the plant which the State Government is obtaining, and with the co-operation of existing Government workshops and those owned by private employers, there will soon be a large output of shrapnel shells there.

After the War: German Preparations.—In an editorial note regarding the efforts which Germany may naturally be expected to put forth to recover her trading position, "Eastern Engineering" quotes some significant information sent by the New York correspondent of a London newspaper showing the lengths to which Teutonic traders are prepared to go to secure the ends they have in view. It may be that they will find so much of the world against them that their desires will not be realised so speedily as they anticipate, but we are told on the authority of an eminent financial expert that, as one part of the scheme, Germany will require to obtain, and quickly, £200,000,000 worth of raw materials. "She cannot purchase those with bank notes. Accordingly, far-sighted Germans are now, during the war, keeping up the manufacture of iron and steel and storing up the products; they are continuing in the same way the mining of potash, and their dye factories are running at full speed. Germany's scheme is, the moment the war is over, to dump into one big market all the iron, steel, and other materials she has been able to manufacture and store during the war. The only big market available to her is the United States, since South Americans like their bills hung up, and it is an imperative need for Germany to have cash payments so that she can instantly buy with them new stocks of cotton, copper, wool, jute, and so on. For some time past America has been swarming with agents of German steel manufacturers, who are canvassing all American users of steel and telling them, 'Please give us complete lists and specifications of the sheets and tubes you use in your business, for the moment the war is over we shall be in a position to offer you those materials at prices you have never even dreamed of.' Dye manufacturers in Germany are making similar offers, and are besides conducting a most skilful campaign with a view to preventing developments of the American dye industries. This is some indication of the efforts which German traders will make to retain and foster trade." The discussion of "terms of settlement" appears to be a long way off, but it may well happen that the very confident Teutonic commercial calculations with reference to the future will prove to be like some others that have gone wrong. It will be for the Allied Governments, and especially our own, to watch such matters most closely to prevent as far as practicable a revival of the old economic war. We believe that our Coalition Government is fully alive to the possibilities, and that it will have behind it in whatever action it may take to deal adequately with this important aspect of the present struggle, the great majority of British opinion. We are so deeply absorbed with the struggle for life just now that such matters have to wait, but the time will come when victory will force such questions most prominently under everybody's attention.

Early Zeal.—While we are far from wishing to damp the ardour of the youth of England, and while we have no desire here to enter into the National Service controversy, we cannot help feeling that the action of Palmer's Shipbuilding and Iron Co. in taking proceedings against apprentices who have left their work without permission, and enlisted, will meet with approval in many quarters. We can quite imagine that the enticements of the recruiting officer are irresistible to the under-age youngster who is swept up in the waves of patriotism, but Palmer's is essentially a war factory, and its employés are war-workers, and under some circumstances it may be heroic to remain at the tasks of apprentice monotony and resist the "death or glory" appeal. When we are getting back all the engineering labour that we can from the Front it is regrettable that we should lose even the partly-trained men and boys from the places that they rightly occupy in our works to-day. Palmer's is a large company as well as a war concern, and it is able to take action where others by doing so would suffer. Legally, the apprentice cannot break his agreement and enlist unless the employer agrees, but deeds have been broken in innumerable cases. We have in mind a business in a small country town, the principal of which was without three apprentices who had flouted their legal obligations and answered the country's call to older men. He reviewed his position thus: "I can't stop them. How can I object? I shall be the most unpopular tradesman in the town if I do so." We may admire the zeal of our undeveloped lads, grumble at the condition of things that weans them away when eligible slackers hang back, and cheerfully go on bearing our share of the hardships involved, but it is as well that the sanctity of legal obligations should be brought home to the junior mind even in time of war. Certainly we must let war munitions apprentices know beyond all misunderstanding that the bench is as important as the trench in this war.

Belgians as A.S.E. Men.—The Amalgamated Society of Engineers has had under consideration the admission of Belgian workmen into the union, and it has made the following recommendations to the branches:—"Belgian mechanics who can produce proof of membership in a Belgian trade union must join the class for which they are eligible according to our rules, but such candidates will be charged no entrance fee. Where they can prove to have belonged to a trade union in Belgium they are eligible for full membership up to the age of forty-five." Privileges will be granted to Belgians for the war period only, and on the understanding that they return to their own country after the war. If any of them should remain here for a longer period than one month after the declaration of peace they must be charged entrance fee according to the rule of their age on admittance to the society. The recommendations are not applicable to candidates who were not financial members of a Belgian trade union prior to their starting work in Great Britain.—"Ironmonger."

Australia and Enemy Companies.—An Australian newspaper ("Melbourne Age") just to hand states that on July 12th, in the Central Summons Court, Sydney, the Amalgamated Wireless (Australasia) Ltd., Ernest Thomas Fish and Charles Bartholomew were charged with having traded with the enemy. It was alleged that on or about December 8th, 1914, defendants had, by entering into a contract with Gesellschaft fur Drahthlose Telegraphie mit Beschrankter Haftung, of Berlin, traded with the enemy. "Entering into an obligation" was also alleged. Mr. Bavin, for the defence, applied for an adjournment, on the ground that Mr. Denison, one of the directors of the company, was absent in Northern Queensland, and had not yet been served with the summons. The case was adjourned until July 28th.

A proclamation, issued at Melbourne on July 9th, declared the Australian Metal Co. to be an enemy subject. On July 10th, according to an Australian paper, two directors of the company (W. Friedrich Christian Schmidt, and Franz Wallach) were arrested and interned by officers of the Intelligence Corps. Both were naturalised and had lived in the Commonwealth for many years.

Metropolitan Munitions Committee.—It will be of interest to the engineering world, and to manufacturers generally, to learn that the organisation of the Metropolitan Munitions Committee is now practically complete, and that most excellent work is being done. A central office has been established at Alexandra House, Kingsway, with Mr. Cecil Partridge as general manager, and Mr. Ireland as chief engineer, with a competent staff and commodious premises. The jurisdiction of the committee extends over the whole of the Metropolitan Police area, which has been divided into ten districts, each under a district manager, associated with an assistant and a munitions engineer; and the following gentlemen have been appointed as district managers:—

Northern.—Mr. A. Hugh Seabrook (acting), 62, Finsbury Pavement, E.C. (temporary address).
North-Western.—Mr. E. T. Ruthven Murray, 346, High Road, Kilburn, N.W.
Southern.—Mr. A. C. Cramb, Town Hall, Croydon.
South-Eastern.—Mr. W. G. Head, Borough Hall, Royal Hill, Greenwich, S.E.
South-Western.—Mr. C. O. Grimshaw, 6, Eccleston Place, S.W.
Eastern.—Mr. C. Newton Russell, 215-217, Bishopsgate, E.C.
East Central and part South-Eastern.—Mr. E. Harlow, 64, Bankside, S.E.
Western.—Mr. R. S. Downe, Carnegie Library, Hammersmith, W.
Poplar and Stepney.—Mr. G. M. Gill, East London College, Mile End, E. (temporary address).
Outer Eastern.—Mr. S. H. Wood, Gas Works, Beckton.

Any information likely to be of use in connection with the production of munitions, and all inquiries, offers of premises, of tools, plant or services, etc., should be directed to the General Manager, Metropolitan Munitions Committee, Alexandra House, Kingsway, or to one or other of the District Managers, according to the district.

Copper Shortage in Germany.—Reuter's agent at Zurich states that agents are conducting a diligent and systematic hunt for copper throughout Switzerland. They are penetrating the mountains to the remotest valleys, and persuading the peasants to part with this precious metal. Taking advantage of the ignorance of these country-people they tell housewives that their copper utensils are burned out, and offer to give them new pots and kettles in exchange, which, of course, prove to be of greatly inferior metal. The business is enormously profitable, since the agents pay only 2d. to 4d. a lb. for copper which they sell to Germany for ten times as much. The Germans are constantly finding new ways of getting copper from the Swiss. There are no brass smelters in Switzerland, and taking the advantage of this the Germans insist upon receiving an equal amount of copper for every delivery of brass. And as brass weighs only about one-half or three-fifths as much as copper the Germans obtain a large surplus.—"Financial Times."

War Substitutes in Germany.—A long discussion on substitutes for raw materials which the war had made scarce or unavailable, was recently held by the Mannheim branch of the Verein Deutscher Ingenieure. Various materials were considered, and details were given of experiments now being carried on at several electric power-stations on the best ways of burning coke mixed with coal or lignite in boiler furnaces. Rubber was also discussed. It was stated that the production of synthetic rubber seemed nine-tenths successful, but the final part of the problem had never been solved. Not only the Elberfeld Dye Works, whose investigations looked very promising a few years ago, but also the Badische Anilin und Soda Fabrik had experimented on a large scale; but the researches had not been pushed of late, because the prices of rubber had gone down (before the war), and because the artificial rubber proved disappointing in use.—"Engineering."

Australia Taking Stock of Metals.—According to an Australian newspaper, the Federal Government made an order recently that persons holding more than certain quantities of steel, including steel ingots, blooms, slabs, billets, bar, rod, angle, tee, scrap, and bar and tool steel; pig iron, scrap iron, wrought iron, bar and sheet; copper ore, blocks and ingots, plate and sheet zinc or spelter, including ore, sheet, bar, blocks, lead ore, sheet and pig lead, nickel, block tin, aluminium, ferro-manganese, ferro-silicon, or antimony, must supply the Commonwealth Statistician with particulars.

Munition-Workers to Visit the Front.—The "Sheffield Independent" states that a party of munitions workers are to be sent to the front for the purpose of enabling them to judge first-hand of the necessity for increasing the amount and accelerating the production of munitions of war. The following trade unions have been asked to send representative workmen:—Engineers, brass founders and copper smiths, plumbers, boilermakers, shipwrights, union of labour, blacksmiths and ironworkers, sheet metal workers and braziers, electrical trade, patternmakers, ironfounders, tool makers, machine workers and engine makers.

Lighting Precautions: Bridlington Engineer Fined.—At the Bridlington Police Court, on Saturday, Mr. Frederick Ffrench (acting borough electrical engineer), was summoned for failing to obscure the light from the roof of the engine-house at the Bridlington Electricity Works. Evidence was given by two special constables, members of the Bridlington Town Council, the East Riding County Council, and the local Magisterial Bench that the light coming from the works constituted a danger to the building itself and to the community. A fine of £3 was imposed.

New Zealand and Enemy Goods.—Reuter's correspondent at Wellington states that Sir Joseph Ward, Minister of Finance, in laying the new Budget before the House of Representatives, said that in the Customs increases motor-cars, chassis and bodies would pay 10 per cent. ad valorem, with 50 per cent. additional on cars made in enemy countries. In addition to the individual increases in the Customs, he proposed to put an additional increase of 50 per cent. on all importations from countries that are or may be enemies of the British Empire.

Electric Fans for Military Hospitals.—An appeal for help in sending 150 electric fans to the military hospitals in Malta has been published in the daily papers by Miss Olga Nethersole, of Heathland Lodge, East Heath, Hampstead, N.W.

The Air Raid at Mülheim.—A squadron of Allied aircraft on the morning of August 27th bombarded the station and the electrical installation at Mülheim, in the Grand Duchy of Baden.

Machine Guns from Canadian Electrical Men.—The "Canadian Electrical News" states that the chief officers of the Montreal, Light, Heat and Power Co. have made contributions of machine guns for the Canadian troops; Mr. J. S. Norris, the general manager, Mr. R. M. Wilson, chief electrical engineer, and the heads of the departments, have each contributed a gun. The employés of the Northern Electric Co., Ltd., have purchased two guns.

The Government and War Badges.—The "Times" states that firms manufacturing war badges in Birmingham have received an intimation from the Minister of Munitions that all permissions given for the manufacture of private war work badges have been cancelled. The Government view with disfavour any private badges which suggest that the wearer is engaged in Government work.

Fighting the Submarine.—Writing from Geneva, Signor Emile Guarini, an Italian electrical engineer, well-known for many developments with which his name is connected, especially in the field of wireless telegraphy, informs us that he has invented an electrical arrangement for dealing with submarines, which he has submitted to the naval authorities of each of the Allied nations.

REVIEWS.

Modern Boiler Practice and Smoke Abatement. By Jas. T. Hodgson. London: The *Railway Engineer*. Price 3s. 6d. net.

The author of this book has set himself a task which is capable of an endless variety of fulfilment. The method he has chosen is that of illustrating and describing a very large number of boilers, furnaces, and accessories, so that there might be cast up against him the crime of making a catalogue book. But this would be an unfair description, for this is no mere bald catalogue, but a good work, for the illustrations are really illustrative of appliances which do enter into boiler practice very largely or are characteristic of the trend of practice, and such a book as this will appeal very much to the engineer-in-charge or the young power-station man who wishes to get ideas of what is being done.

The author connects everything very well by his own criticisms and reasonings, and is a safe guide to follow, evidently having a good grasp of his subject and understanding the subject of combustion. With 20 chapters to compress into 300 pages, the treatment of each item in each chapter must necessarily be very brief, and any fault that may be found is that the number of headings in each chapter is somewhat large. The wide range of subjects treated includes coal, draught, firing or stoking, conveyors, gas analysis, mountings, feed heating, steam, calorimeters, and so on through almost every detail of practice and apparatus. The author makes good comments, notably on feed heating with live steam, and superheat, but he omits to name the precaution of drilling a small hole near the top of the closed plate sliding damper so that gas cannot accumulate behind the closed damper with the danger of being exploded by sudden break up of the fire before the dampers are raised. The drilled hole allows gas to escape which might otherwise accumulate at the flue crown.

Incidentally, also, the too common error is made of using the plural form "strata" when referring to a single stratum. And, though probably of little importance, the diagram of the old wagon boiler is not correct. In the wagon boiler the top included a complete half-circle at least, which joined up directly with the hollow sides. Many of these boilers have been seen by us, and never one of the form shown by this book, with a flatly curved top joined by small radius curves to the hollow sides and with no steam room above the side flue level. This is of no moment, however, except that it is so long since the days of the wagon boiler and its pressure of ∓ on the gauge—if there had been gauges in those days—that it might be well left out of a modern book and studied only as a matter of archæological interest in older books.

Nor does the description of the calorimeter add value to the book. When a modern instrument is described whose object is to measure steam wetness, the student is, rightly, apt to think that such an instrument is reliable. Without doubting the capacity of the calorimeter to measure the dryness of the steam passing through it, that steam cannot be known to represent the steam in the pipe whence the sample is taken. No means of taking a sample have yet been devised which are worth a moment's consideration. The only possible reliable method, viz., to condense the whole output of the boiler, is too wasteful, too costly to undertake, and too cumbersome. There is one cure for wetness, and that is to superheat the steam beyond, say, 215 deg. F. at least, and use the only safe calorimeter—a thermometer—to record the dryness of the steam. Steam which is wet is not steam, but an unfinished product unfit for use in a heat engine.

Very properly, a chapter on superheat follows that on the calorimeter, and here the author draws attention to the water-screen placed in advance of the directly-fired superheater so as to conserve the superheater tubes by letting down the gas temperature. The water screen is the only sound method of doing this, and it is to be wished that the use of great volumes of cold air which are sent hot up the chimney will be abandoned. This book should be in the hands of all engineers in charge of boiler plant.

Principles and Practice of Electrical Engineering. By Alexander Gray, B.Sc. London: Hill Publishing Co. Price 12s. 6d. net.

This book is based on the lecture and laboratory course given to the senior civil, mechanical, and mining students at McGill University, Montreal, Canada. It is suited to the requirements of men who desire to obtain a broad idea of the principles and practice of electrical engineering, but who have only a limited amount of time to spend on the subject. This statement must not, however, be taken to suggest that the book is in any way a superficial study of electrical engineering. On the contrary, the fundamental principles are thoroughly emphasised and the subject is developed by elaborating these principles along essentially practical lines.

The first two chapters are given to the fundamental principles of electricity and magnetism, chapters X to XXI to the construction, operation and control of D.C. machinery, and chapters XXVII to XXXIX to alternating currents. There are also chapters on electrolysis, storage batteries, traction, lighting and transmission. The first two chapters on magnetism and electromagnetism are models of brevity and clearness, and, in fact, the whole of the introductory portion of the book is consistently good. The insertion of completely worked examples in the text is an excellent feature.

Considerable attention is given to practical details of construction even in the simpler instruments, such as rheostats and resisters, and in Chapter VI descriptions and illustrations are given of all the practical types of adjustable and standard resistances. An equally thorough treatment is given to solenoids and electromagnets of all kinds.

Two chapters are devoted to the construction of the D.C. generator. The treatment is brief, and, although it cannot be called scanty, yet, perhaps, the importance of the subject would have warranted some amplifications in certain places. The three equally brief chapters on commutation, armature reaction, and D.C. characteristics are, however, all that could be desired. The sections dealing with D.C. motors are also very satisfactory, especially the portion on adjustable speed operation. The practical uses to which the various types of

motors may be put are carefully considered, and the discussion is illustrated by worked examples from practical data.

The principles of alternating currents and their application to inductive and capacity circuits are dealt with very thoroughly in four well illustrated chapters. These are followed by chapters on alternators, synchronous and induction motors and transformers. The illustrations throughout the A.C. portion of the book are excellent, and colours are used to distinguish between the various phases, both in the diagrams of machines and in the vector diagrams. Completely worked out examples also add considerably to the value of these chapters.

In the short treatment of electric traction and transmission and distribution given in chapters XL and XLI, the method adopted is almost entirely that of taking typical cases and working out the details from actual practical data. And from all points of view this method is astonishingly successful, for all kinds of practical problems can be worked on the models given. It is certainly far more satisfactory than the method of juggling with mathematical symbols and obtaining the hideous and often meaningless formulæ which characterise some of the older text-books of this type, especially in view of the practical type of student for which the book is primarily intended.

The chapters on batteries and electric lighting are extraordinarily complete considering their brevity, and, in fact, the whole work bears the hall-mark of sound experience and accurate, complete knowledge of the science. The last chapter of the book consists of an appendix of twenty laboratory experiments illustrative of the principles treated in the previous chapters. Pertinent questions follow each experiment.

It would be difficult to suggest any improvement in Professor Gray's book except, perhaps, the amplification of the chapters on D.C. machines and the addition of a collection of exercises based on the examples worked out in the text. It is certainly one of the best books on electrical engineering that any kind of engineering student could wish to study from.—P.H.S.K.

Hand Lettering for Engineers, Architects, Surveyors and Students. By W. J. LINEHAM. London: Chapman and Hall. Price 7s. 6d. net.

This treatise is unique, and the more one studies its pages the less is one able to understand how so splendidly produced a work, involving such labour in its preparation, can possibly be sold at the very reasonable price placed upon it. However, the feat has been accomplished, and there is now within the reach of all a work which covers completely all but freak lettering methods, and should do a great deal to encourage neatness and proficiency in what is still a very important branch of the draughtman's art. As a matter of fact, hand lettering is required in drawing and designing offices of all kinds to a far greater extent than is generally appreciated, and that it should be done as well and as quickly as possible goes without saying. To cite only two respects in which hand lettering does what mechanical lettering cannot do, the former can be adapted in infinite variety to the exigencies of space and style and in those schedules which are more and more commonly employed on machine drawings, hand lettering is alone applicable

The plates here presented include alphabets suitable for mechanical, electrical, constructional and civil engineers, architects, and architect decorators. They should be useful, as well, to map draughtsmen, Patent Office draughtsmen, and authors making their own drawings. Students and men in practice will alike find the work valuable, and any doubts they may experience as to the justification for so extensive a treatment of the subject will quickly and progressively vanish as they appreciate the gain in efficiency as well as appearance resulting from systematic practice along the lines advocated by the author. After the necessary proficiency has been attained, the book still remains valuable as a work of reference. Capital and small letters for each alphabet, figures and fractions, all in various sizes, form the subject of each group of plates. The characters are arranged first in order of difficulty, then in alphabetical order, and, finally, in words and actual phrases and titles, the better to illustrate the principles of spacing and balance. Working instructions and warnings are given for each plate, together with practical notes concerning the applicability of each fount.

Short sections are devoted to line shading of drawings and dimensioning methods. The preparation of scales is dealt with usefully, and instructions are included for the preparation of Patent Office drawings. The notes on zincography deserve special mention, and should save those who prepare line drawings for reproduction clear from many pitfalls. Another valuable feature is the section on photo-printing processes as used in drawing offices. In conclusion, folding plates are included to illustrate the application of various methods and alphabets in first-class modern drawings of a variety of types. The whole treatise is entirely above criticism, and should render sterling service in rescuing an important and thoroughly justified handicraft from the semi-mechanical mistreatment to which it is so often subjected and in securing authoritative form to lettering which, as the evolution of generations, is not likely to be improved by the sporadic inventions of a rampant imagination.

THE RUSSIAN ELECTROCHEMICAL INDUSTRY.

THE serious shortage experienced in the supply of various electrochemical products in Russia since the outbreak of war has attracted much attention to the position and prospects of electrochemical industries in that country. Hitherto no aluminium has been made in Russia, though the demand (particularly during the last year) has been considerable for aviation purposes, utensils of all kinds, and as a substitute for copper in electrical applications. Magnesium and sodium have not been produced commercially in Russia, and large sums have been paid annually to Germany and America for carborundum. Other materials exclusively imported include calcium cyanamide, hydrogen-per-oxide, and "Berthollet salts," or fulminating silver. Practically nothing has yet been done there in respect of the electrical manufacture of steel, nor have the electro-thermal processes associated with zinc, phosphorus and carbon bisulphide been investigated, and, as a natural consequence, there is no native industry for the manufacture of accessory material such as carbon electrodes. There are believed to have been only two calcium carbide furnaces in Russia on the outbreak of war, whilst for the manufacture of ferro-silicium, ferro-chrome, and other special alloys, there was one small works in the Urals, and for the manufacture of fulminate there were reopened one works in the Government of Petrikau and one in Imatrafall (Finland). On the other hand, the electric refining of copper, the manufacture of accumulators, and the production of lye and chlorine were flourishing branches of electrochemical and electrometallurgical manufacture.

According to the latest available official statistics, consumption and imports of various materials during 1912 were as follows :—

	Consumption.		Imports.	
	Tons.	£	Tons.	£
Electrolytic copper	21,000	1,930 000	9,400	595 000
Lye and etching salts	88 500	1,010,000	355	5,700
Accumulators	3,390	180 000	27	5,400
Aluminium	1,290	170,000	1,290	170,000
Berthollet salts and sodium chlorate	2 800	114 000	2 800	114,000
Abrasives	1,110	67 000	1,110	67,000
Electro-steel	4 030	66,100	1,940	32,900
Calcium-carbide	1,450	42,500	129	6,250
Norw. saltpeter and calc. cyanamide	2,200	10,700	2,200	10,700

The conditions necessary for the healthy development of electrochemical industry in Russia are :—Cheap power, sufficient raw materials, free capital and trained employés. As to the sufficiency of raw materials available there is not the least question, the materials chiefly required being coal, clay, sand, lime, common salt, and hydrogen, besides the various metals concerned, which are available in plenty. The capital expenditure involved is not heavy, except in the case of aluminium and nitric acid plant, and, in any event, the necessary funds should be forthcoming quite readily from native sources after the war, when the ramifications of German intrigue in Russian finance and industry have been thoroughly eradicated. Nor is there any doubt that skilled employés can be obtained in sufficient numbers and with suitable qualifications or aptitude for learning. The crux of the whole problem lies in the availability or otherwise of electrical energy at a sufficiently low price.

The average market prices of various materials in Russia in 1913, and the maximum price of electrical energy at which it is estimated profitable electrochemical manufacture could be conducted, are as below :—

	Market price per ton.		Max. competitive price for electricity.
	£	s.	
Refined copper	92	0	1·28d. per KW.-hr.
Calcium carbide	26	6	1·17d. ,,
Berthollet salts...	59	4	0·72d. ,,
Sodium chlorate	71	0	0·64d. ,,
Caustic soda	16	8	0·41d. ,,
Ferrosilicon (50 per cent.)...	41	2	0·17d. ,,
Aluminium	85	10	0·15d. ,,
Calcium nitrate	11	16	0·06d. ,,

Current for lighting purposes is commonly sold at from 5d. to 10d. a unit in Russia, that for power purposes selling at from ½d. to 2½d. per unit, but for extensive electrochemical developments, current at 0·03d. to 0·125d. per unit

is desirable. Russia is at present so deficient in large hydro-electric works that it can hardly be practicable in the near future to establish such electrochemical industries as the fixation of atmospheric nitrogen or the manufacture of aluminium in that country. The limitation is, however, only temporary. It is considered that the institution of a high import tariff would encourage the development of the industries concerned, but such could, or, at any rate, should, only be a temporary expedient, as it would necessarily involve an inflated market price for the protected products.

Healthy development in this, as in so many other Russian fields, depends on the erection of really large power development schemes, and from the market opened out, directly and indirectly, by the latter, British manufacturers may reasonably hope to derive considerable benefit. Large stations must sooner or later be erected in the hard coal districts (*e.g.*, the Donetz area), and in or near the peat fields, from which ammonia and other valuable by-products could be derived, thus simplifying considerably the economic problem. At least 100,000,000 KW. could be derived from water-power in Finland and in the Urals and Caucasian districts, and it is estimated that 300,000 KW. of hydro-electric power could be developed in the Petrograd district alone and sold for electrochemical purposes at 0·03d. per KW.-hour. The fatal policy of taxing electrical energy must naturally be completely abandoned before any industry can hope to succeed which uses electrical energy in bulk.

The availability of hydro-electric power in Russia, and the possibility of utilising it profitably, are beyond question, and whilst the chief ultimate benefit will be to Russia herself, it should not be overlooked that there will be an enormous demand for imported material and plant in the years following the war, and conditions will be more favourable than ever before for attaching a large share of this business to British interests.

BUSINESS NOTES.

Catalogues and Lists.—MESSRS. PERKIN & CO., LTD., Junction Works, Leeds.—Illustrated and priced descriptive lists relating to high-speed hack saws, bench millers, cutter grinders and shapers.

MESSRS. ELECTRO GALVANIZERS, LTD., 16, Green Street, Trafalgar Square, London.—24-page pamphlet containing notes on electro-deposition and illustrations of nails, screws, bolts, chains, metal lift cages, steel casements, railway ironwork, electric fittings, and other articles dealt with by their patent processes.

MESSRS. L. E. WILSON & CO., 10, Corporation Street, Manchester.—8-page pamphlet giving a list of electric light and power installations carried out by them for cotton mills, engineering works, warehouses, public buildings, &c.; also a few half-tone pictures showing some of the electric power applications in such places.

MESSRS. CARRON CO, Carron, Falkirk.—20-page pamphlet containing excellent illustrations, brief particulars, and prices of Carron electric heating appliances, including luminous and other radiators, bathroom stove, electric fires, and dog grate fires.

MESSRS. HEMMING CONDUIT GRIP, LTD., Hatherton Works, Walsall.—Four-page illustrated circular giving particulars and prices of the "Hemming" grip electrical conduit fittings.

MESSRS. MATTHEWS & YATES, LTD., Cyclone Works, Swinton, Manchester.—Eight-page illustrated pamphlet containing particulars of their "Cyclone" electric fans and exhausters, and oxy-acetylene welding and metal-cutting plant.

BRITISH THOMSON-HOUSTON CO., LTD., 77, Upper Thames Street, London, E.C.—Four-page illustrated price list of "Mazda" drawn-wire electric lamps relating to the following voltages and sizes:—20-89 volts, 6-60 watts; 100-155 volts, 10-150 watts; 200-260 volts, 15-150 watts; H.C.P.—100-260 volts, 100-400 watts. Prices are also given of candle, Mazdalite, sign, tubular, steamship, and traction lamps. All of these lamps are manufactured at Rugby.

For Sale.—Farnworth U.D.C. invites tenders for the purchase of one 150-KW. high-speed, direct-coupled, steam-driven dynamo. Particulars are given in our advertisement pages.

Australia.—The Commonwealth Defence Department having taken over the engineering works on Cockatoo Island, belonging to the N.S.W. Government, arrangements are in hand for converting it into a dockyard. The work to be carried out includes the installation of a large electric generating plant, tenders for the supply of which are at present being invited. The plant to be installed comprises three 1,000-KW. geared turbo-generators and one of 225-KW. capacity, four 750-KW. turbo-generators, three 500-KW. generators, two 1,200-ampere rotary balancers (250-125 volts), and two of 600-ampere capacity, five 600-KW. Diesel engines, and one of 225-KW. capacity.

Dissolutions and Liquidations. — CONSOLIDATED DIESEL ENGINE MANUFACTURERS, LTD.—Mr. W. B. Peat, the liquidator, in the summary of his accounts in this matter, gives the following particulars:—*Receipts:* Balance, £8,155; book debts, £1,140; surplus from securities, £110,331; receipts per trading account, £1,629; other receipts, £44, making £121,299; less payments to execution and other secured creditors, £29,720; payments to creditors sanctioned by Court, £816; payments per trading account, £926 = £31 461, making £89,838. The *payments* were:—Salaries, wages, cost of completing contracts, Board of Trade and Court fees, law and other costs, £1,559, leaving a balance of £88,279.

G. STRAUS & CO., LTD.—This company is winding up voluntarily, with Mr. W. J. Colquhoun, of 211, Upper Thames Street, E.C., as liquidator. A meeting of creditors is called for September 6th.

WILLIS & HALLOWELL, engineers' agents, electrical engineers and merchants, 211, Corn Exchange Buildings, Manchester.—Messrs. R. H. Willis and W. Hallowell have dissolved partnership.

VENNER'S ELECTRICAL COOKING AND HEATING APPLIANCES, LTD.—The adjourned meeting of creditors will be held at 65, London Wall, E.C., on Thursday, September 9th, at 12.30 o'clock.

Bankruptcy Proceedings.—ARTHUR FARADAY HAWDON, electrical engineer, Yetholm, Elmfield Gardens, Gosforth, Northumberland. The following are creditors herein:—

Batty, G. L., Newcastle-on-Tyne	.. ..	£243
"Bankers,"	"	199
Parker, Miss M. M. W.	"	102

The Chinese Market: Long Credit.—In the course of an article on "British Manufacturers and the Machinery Trade of China," *Eastern Engineering* writes as follows:—"There is an unlimited outlet for machinery in China, but the drawback is that the Chinese usually have no money to pay the purchase price, and ask for payment facilities. The reason why German firms occupy such a dominating position in the machinery market of this country is due to the fact that they have always met the buyers, taking part-payment upon delivery and the balance extended over a few years. For instance, there are two electrical installations for, together, about 30,000 lamps in a certain district in China, supplied by the Allgemeine Elektrizitäts Gesellschaft, of Berlin. The Chinese company only paid about 15 per cent. of the value of the plant at the time when it was delivered, the balance being made up in instalments divided over six years. In other words, the Chinese usually wish to pay for the plant *out of the profits* which they can make with the installation, and it is very seldom that they can accept the terms given by nearly all the British machinery manufacturers, viz, one-third upon signing the contract, one-third upon shipment, and one-third upon delivery. If British manufacturers wish to get the bulk of this trade in China, or at least a fair share of it, they will have to give facilities for payment. The fact that German competition is tied up now does not alter the situation much as regards terms, because the Chinese *cannot* buy the machinery if they have to pay in full for it; they have no money, and unless they are assisted by sellers the business is simply impossible. To mention a few of the leading engineering schemes worked in China by German firms on the basis of extended payments, the following Chinese companies in the Yangtsze Valley alone will show how German manufacturers got a strong hold of the trade:—

Hunan Electric Light Co. at Changsha.—Contract about £15 000, payment in six years.
Chungking Electric Light Co.—Contract about £8,000, payment in four years.
Shasi Electric Light Co.—Contract about £4,000, payment in five years.
Siangtan Electric Light Co.—Contract about £12,000, payment in six years.
Changsha Cotton Mill.—Contract about £110,000, payment in five years.
Hunan Telephone Co.—Contract about £90,000, payment in three years.

"To the foregoing might be added hundreds of smaller concerns for pumping, mining, printing, flour mill, rice mill machinery, &c. The purchase price is even of less importance than the question of terms, and British machinery can be better and cheaper than anything else in the world, but it is the *terms* which the Chinese require."

Annual Outing.—The electrical and works staff of the ALPHA MANUFACTURING CO, Balham, held their annual outing at Southend on Saturday, the 21st ult. The staff, numbering about 40, were accompanied by Mr. G. F. Beare and Mr. Harris. Mr. Hill, on behalf of the works staff, proposed the health of Mr. and Mrs. Beare, who were married a few weeks ago, and Mr. Beare, in returning thanks, referred to the fact that the number of employés had doubled itself since last year's outing. Later Mr. Harris, in reply to a toast, stated that the firm were engaged on several important electrical contracts.

Trade Announcements.—MESSRS. CALLAS, SONS AND MAY, LTD., electrical engineers, have opened new premises at 65, 67 and 69, Oxford Street, Reading.

MR. H. A. LEE, late of the Westcliff Electrical Co., of West Road, Westcliff, Southend-on-Sea, has gone into business at Northview Drive, Westcliff.

The GARDY CO. (France and Switzerland), makers of all kinds of electrical fittings and insulators, have appointed as their sole representative for this country and the Colonies, Mr. C. CAMPART, 49, Newgate Street, London, E.C. Telephone: No. 3,497 Central; Telegrams: "Cecampart, London."

Book Notices.—"*Journal* of the Tramways and Light Railways Association." Special Congress Number. August. 1s. The discussions and other proceedings at the Congress are reported.

"*Proceedings* of the Physical Society of London." Vol. XXVII. Part 5. August 15th, 1915. London: *The Electrician* Printing and Publishing Co., Ltd. Price 4s. net.

"Science Abstracts," A and B. Vol. XVIII, part 8. August 30th, 1915. London: E. & F. N. Spon, Ltd. Price 1s. 6d. each.

"Constructional Data of Small Telescope Objectives calculated at the National Physical Laboratory, Teddington." London: Harrison & Sons. Price 2s. 6d. This has been prepared by desire of the Director-General of Munitions Supply, and is intended for the assistance of opticians who may be engaged in the manufacture of optical instruments. The crown and flint glasses for which the calculations have been carried out are those contained in a recent list of optical glasses issued by Messrs. Chance Bros. The Laboratory authorities retain the copyright of these tables.

"*Transactions* of the North-East Coast Institution of Engineers and Shipbuilders." Vol. XXXI. Part 5. Newcastle-on-Tyne: The Institution. Price 5s.

Messrs. Alfred Herbert's *Monthly Review* of Machine Shop Practice for August contains among other things an account of the King's visit to the firm's works in July.

LIGHTING and POWER NOTES.

Armagh.—Proposed E.L.—The Council is to consider a report on an electric lighting scheme for the town, and the town clerk has been instructed to obtain information from Dundalk and Lurgan, where electric lighting had been introduced, for the purpose of the promotion of the scheme.

Batley.—Year's Working.—According to the abstract of accounts for the year ended March 31st last, the Corporation electricity works commenced the year with a credit balance of £138, and a net profit of £634 on the year's working has been made, making a total of £772, of which £714 has been allocated to the liquidation of a debt in respect of a new switchboard. For the past 10 years the figures of profit and loss have been as follow:—1905-6, loss, £61; 1906-7, profit, £494; 1907-8, profit, £121; 1908-9, loss, £307; 1909-10, profit, £170; 1910-11, loss, £127; 1911-12, loss, £37; 1912-13, profit, £1; 1913-14, loss, £116; 1914-15, profit, £634. The capital expenditure on the undertaking to date amounts to £55,721.

Belfast.—Power Station Fire.—In our last issue we referred to the fire which occurred at the Corporation electricity works; we now learn from Mr. Bloxam, the city electrical engineer, that this fire occurred early on the Sunday morning, involving the part of the building immediately over the bunkers. This portion of the building was designed to avoid coal dust causing a nuisance in the adjoining street, and was in consequence poorly ventilated, but was constructed largely of wood. Heating in one of the bunkers liberated sufficient gas to fill this structure; the gas became ignited, and fired all the woodwork simultaneously. The damage is chiefly confined to this structure and the coal conveyor, which is partly destroyed; there was no interruption to the electricity supply whatever, the fire brigade effecting a splendid save of the adjoining buildings. The whole damage is covered by insurance, and the work of restoration will easily be completed before the winter's load.

Bispham.—An agreement has been entered into for a supply of electricity to be given to the premises of the Cleveleys Hydro., Ltd.

Blackburn.—Price Increase.—The Electricity Committee is to consider, in view of the increased cost of fuel, whether the charges for current should be increased.

Blackpool.—The effect of the lighting restrictions at Blackpool "in the season" may be judged to some extent by comparative figures for July this year and July of 1914. The falling-off in July this year is no less than 146,471 units, the largest decreases being 64,786 units for private lighting, and 77,090 units for tramway purposes. Over a period of four months, the decrease in the units consumed amounts to 231,100 units—127,720 units being due to the decreased demand of the tramways department. During the four months 100 new consumers have been secured, as against 187 in the corresponding period of last year.

Bolton.—The Electricity Committee has made a grant of £10 to the Engineering Standards Committee towards the fund necessary to carry on the work of electrical standardisation.

Brymbo.—E.L. Proposals.—The Brymbo Steel Works, in reply to a communication from the P.C., has intimated that it has no objection to the Wrexham T.C. extending its area for the supply of current to the parish, as it does not intend supplying electricity for private purposes. The Council has decided to offer no objection to the application of the Wrexham T.C. for a prov. order.

Canada.—Life of Half-Watt Lamps.—The Hamilton Hydro-electric Department makes careful records of the life of different lamps, and so is accumulating valuable information regarding the relative merits of the various types. During 1914 the city installed approximately 1,000 500-watt nitrogen lamps and a report of May 22nd, this year, states that 977 lamps had given a total of 1,456,848 hours of light. This is an average of 1,491 hours per lamp, including all troubles. Even at that, a very large percentage of the original lamps were still in operation.

The contract for the construction of La Loutre Dam, on the St. Maurice River, 52 miles from the mouth of the Manouan River, P.Q., has been let to the St. Maurice Construction Co. The price is $1,425,000. The dam will be of great benefit to the hydro power companies and plants on the St. Maurice River, and the Quebec Government, which has undertaken the enterprise, is assured of sufficient annual income, from the companies having plants, to more than pay for the maintenance charges and interest on the capital cost. The storage proposed will increase the power at Shawinigan over the low water year of 1906 by 32,000 H.P., and will double the low water possibilities of the St. Maurice River at that point.—*Canadian Electrical News.*

A hydro-electric scheme which is talked of involves an expenditure of about $100,000,000 in damming the lower Niagara River, and developing 2,000,000 H.P. of electrical energy for use on both sides of the boundary. This would be accomplished by constructing a 90-ft. dam, just above Queenston and backing the water up practically to the foot of the Falls.

The proposal was presented last week to the Joint Legislative Commission of New York State by Mr. P. A. Porter, who nearly 30 years ago introduced the original Power Development Bill.

There is no relation, it is stated, between this scheme and that of the Hydro-Electric Power Commission of Ontario.—*Canadian Engineer.*

Cardiff.—Price Increase.—Owing to the advance in the price of fuel, &c., the T.C. has decided to notify all consumers other than those under special contract, that the charges for electricity will be increased as from October next.

Continental Notes.—Spain.—The *Gaceta de Madrid* states that Don José Echevarria Lavin and others have been authorised to utilise the waters of the Rio Cares, in the district of Posada de Valdéon, Province of Leon, at the rate of 3,400 litres per second, for the production of electric power for lighting and other industrial uses.

The *Gaceta* may be consulted at the Commercial Intelligence Branch, B. of T.

An electric lighting station has been installed at Tetuan, Morocco. The plant consists of an 80-H.P. generating set, driven by steam power, creosote being used for fuel.

Coventry.—Loan Application.—The E.L. Committee of the T.C. has applied for a loan of £80,088 for the provision of new plant and for building extensions at the E.L. works. The extension is required for Government purposes.

Fermoy.—E.L. Scheme.—The U.D.C. had under consideration an application from the firm of electrical engineers, which is carrying out the scheme of electric lighting for the town, for permission to provide overhead instead of underground cables, as originally intended. The Council decided that the original scheme should be carried out.

Glasgow.—Restricted Lighting.—According to the *Scotsman*, the lighting of the streets is to be reduced by one half after midnight in order to reduce the expenses, and to make the city less conspicuous from above. When the new system is adopted the electric lights on one side of each street are to be extinguished at midnight.

Haslingden.—The T.C. has referred to the Electricity Committee a communication from the Helmshore Co-operative Society, asking whether there was any probability of the Corporation's extending the electric cable, to give a supply to Helmshore in the future.

Market Drayton.—The E.L. and Power Co., Ltd., has applied to the B. of T. for permission to erect 240-volt overhead lines in several streets in the town. The company was recently given the public lighting contract for the town.

Manchester.—Loan Sanction.—The Sanitary Committee has received sanction to borrow £684 for works in connection with the electric lighting installation at Baguley Sanatorium.

The City Council has rejected the resolution by Councillor Clyne, that an independent expert be appointed to inquire into the whole policy of the Electricity Department; only two votes were recorded for the resolution.

Portrush.—The B. of T. has extended the time for the laying of the mains in certain streets under the Portrush Electric Lighting Order, 1913, for one year from August 15th, 1915.—*Belfast News Letter.*

St. Helens.—L.G.B. Inquiry.—An inquiry was held on the 26th ult. into the application of the Corporation for permission to borrow £15,000 for electricity works extensions and additions to plant. The proposed work comprises the enlargement of the engine house, £850; the installation of a 3,000-KW. turbo-alternator and condenser, £9,985; switchgear, £515; water cooling tower, pipe works, &c., £1,250; water-tube boiler and mechanical stokers, £1,750; and £650 is set apart for contingencies. It was stated that the application for borrowing powers had been hastened by the increasing demand for electrical energy by firms employed on Government work.

Salford.—The Electricity Committee has decided that all power supplied to motors employed in driving electric generators producing energy for lighting purposes shall be charged at lighting rates, except in the case of motor generators used for cinematographs, when the charge will be a flat rate of 2½d. per unit.

South Shields.—Year's Working.—The annual report on the working of the Corporation electricity undertaking for the past year shows that the revenue was £34,482, as compared with £33,775 in the previous year, an increase of 2 per cent.; the expenditure amounted to £17,534, an increase of £712 due chiefly to heavier rents, rates, and taxes. The gross profit was £16,948, as compared with £16,953, and after providing for interest and sinking fund charges, &c., there was a net surplus of £3,215, as compared with £3,484 in the previous year. Of this, £1,600 has been contributed to the rates, and the balance placed to the reserve fund, which stands at £16,335. The net amount provided for the extinction of debt since the inception of the undertaking has been £88,568, equal to 41 per cent. of the total capital expenditure. The engineer, Mr. H. S. Ellis, reports that satisfactory progress has been made in connection with the electrical clauses of the Corporation Bill, and it is hoped to be in a position shortly to hire out electrical apparatus, such as motors, heaters and cookers, at a nominal annual charge.

U.S.A.—Flooded Power Plant.—On August 3rd last, the French Street station of the Erie Electric Co., in Erie, Pa., was wrecked by a flood, which at its height left 20 ft. of water in the buildings, covering the engine foundations with over 2 ft. of mud and choking the machines with sand, &c. The generators were completely submerged, and it was several days before the machines were finally dried out and ready for service again. The company received immediate assistance from the staffs of neighbouring E.L. Cos., while the Westinghouse and General Electric Co.'s dispatched experts and repair equipments, and apparently the plant resumed operation in about 10 days' time. The station had previously given uninterrupted service for 27 years.—*Elec. World.*

TRAMWAY and RAILWAY NOTES.

Aberdeen.—Year's Working.—With further reference to the year's working of the Corporation tramway department, of which some particulars were given on page 142, the total revenue, £88,002, was the highest so far obtained, being an increase of £2,735 on the previous year, despite adverse conditions. Of the net profit, £7,590 has been carried to the reserve account, which now amounts to £36,805; the depreciation fund stands at £152,997. The average total revenue per car-mile was 11·06d., and average working expenses per car-mile 6·48d. The units used for traction purposes were 2,317,204, at an average cost of ·845d. per unit. During the year £10,250 was expended out of capital, making a total capital expenditure to date of £366,332.

Belfast.—At a special meeting of the Tramways and Electrical Committee, the Sub-Committee appointed to consider the reduction of the working expenses of the tramway system, submitted certain recommendations to achieve the desired effect, the estimated saving being £4,300, or within £700 of the estimated deficit, in conjunction with the raising of the fares on the Glengormely line.

Blackburn.—A Sub Committee has been appointed to revise the tramway fares, with a view to obtaining a larger revenue by a re-arrangement of stages, and, it is stated, increases on certain sections. An alternative policy is favoured by a section of the Council of a system of penny fares for any distance within the boundaries.

Blackpool.—Figures presented by the manager to the Tramways Committee show that at the end of July the total decrease of tramway revenue was £8,700. By August 19th this figure had been reduced to £5,660. The season figures are much better than anticipated, though it is not likely the whole of the present £5,660 decrease will be made up.

Continental.—Portugal.—The *Diario do Governo* (Lisbon) publishes a notice that a concession has been granted to the "Companhia Carrisde Ferro do Porto," for the construction and working, for a period of 75 years, of an electric railway from Botica da Maia to the station of Ermezinde. Particulars can be seen at the Board of Trade Commercial Intelligence Department.

Germany.—The Berlin Tramway Co. has greatly increased the number of its female employés owing to the constant drain on the male servants by the military authorities. The number of female conductors at the end of June, 2,000, has now been increased to 2,700, and it is now stated that should the drafts for military purposes continue the entire staff of conductors, numbering 4,900, will be composed of women in the early autumn. Hitherto no attempt has been made to use women as drivers, but it is understood that the military authorities have informed the company that the male drivers will all be wanted in a short time, and that it will be necessary to begin with the training of women. Some 250 ntelligent women have been already selected by the company for nstruction.—*Daily Chronicle.*

Dundee.—Tramway Fares.—The Special Committee of the T.C. has had under consideration the question of taking over a small section of tramway hitherto owned by the Dundee and Broughty Ferry Tramway Co. and also the question of fares. The Corporation tramway manager reported that the fares had been so increased by the company on the part of the line it still possessed that the public would not benefit, although it was for that object that the Corporation took over the section of the line. He suggested that the Corporation could not afford to pay £20,000 for this part of the line, its improvement and working, unless the fares were modified. The Committee decided to recommend the T.C. to terminate the agreement with the company, unless the fares were modified.

Huddersfield.—The Brighouse Corporation has signified its acceptance of the proposal put forward by the Huddersfield T.C. for the postponement of the scheme for the construction of a new line through Rastrick, so linking up Brighouse with Bradford. The scheme is to be delayed until the Parliamentary Session of 1917.

Liverpool.—Traffic Statistics.—The traffic return of the Corporation tramways for the period from January 1st to August 21st, shows receipts amounting to £442,221, as against £443,061 last year, being a decrease of £840. The passengers totalled 95,766,114, as against 94,053,741 in 1914, an increase of 1,712,373. The decrease of £840 in receipts, coupled with an increase of nearly a million and three-quarters of passengers, is explained by the fact that 4,483,775 free journeys were given to soldiers on duty or on furlough, to wounded soldiers and to nurses. These journeys at the average fare would have yielded £22,745.

Manchester.—The Tramways Committee has decided to apply to the B. of T. for a further extension of the period allowed for the construction of certain tramways and the compulsory purchase of lands for and in respect of street widenings and works, and the town clerk has been instructed to take the necessary steps in conjunction with the local authorities concerned.

Female Labour.—The Tramways Committee has decided that a few women conductors should be employed by way of experiment. The latest return of enlistments shows that 2,013 men from the tramways department have joined the Forces, 1,124 being married men, 644 single men, and 245 trolley boys. The allowances made by the department to the men or to their dependents is now at the rate of £70,000 per annum.

Wharfedale.—Railless Service.—Delay is taking place in the inauguration of the railless traction service in Wharfedale, in conjunction with the Leeds City tramways, on account of the impossibility of getting the necessary cars delivered. The builders are engaged on Government work and, therefore, local municipal requirements have to stand aside, and it is impossible to state definitely when the service will be commenced.

TELEGRAPH and TELEPHONE NOTES.

Norway.—The construction of the trans-Atlantic radio-telegraphic station at Stavanger, which has been delayed by the war, is now being proceeded with by the Marconi Co. In order to equip it as a first-class station, and to utilise all the most recent improvements resulting from experience gained in the war, extensive reconstruction is taking place, the cost of which, amounting to £40,000, is being borne by the Marconi Co.

Reduced Wireless Rates.—The Marconi Wireless Telegraph Co. announces that telegrams can now be accepted at its offices to be exchanged between the United Kingdom of Great Britain and Ireland and Bermuda, Turks Island, Jamaica, Antigua, St. Kitts, Dominica, St. Lucia, St. Vincent, Barbadoes, Grenada, Tobago, Trinidad and British Guiana at 2s. 2d. per word for ordinary full rate messages, and at 1s. 1d. per word for deferred messages in plain language. The rates for Bahamas-Nassau for the same classes of telegrams are respectively 2s. 2d. and 1s. 0½d. per word. A service at deferred rates is not at present recognised by the Islands of Porto Rico, St. Croix and St. Thomas, but the rates to these islands for ordinary telegrams have also been reduced to 2s. 9d. per word. The above rates are, in all cases, cheaper than those charged by other companies by 4d. and 2d. per word, and they will be notified by the General Post Office to all provincial offices, in the next Post Office circular.

Spanish Guinea Telephones.—The work of installing telephone lines in Spanish Guinea is proceeding actively. A beginning has been made with the line from Santa Isabel to San Carlos, with the object of uniting the capital with the principal centres of Fernando Po, and it is proposed to continue the circuit from Santa Isabel to Musola and La Conception, for which object the material is being forwarded to the colony, but the necessity of awaiting the construction of the Continental telephone line (Campo to Bata Kogo), which compels the forwarding of the material required to Fernando Po and the convenience of shipping the telephone material to the island in the neighbourhood of the railway, has caused the temporary setting back of the proposal. The telephone is now in operation between Campo and Bata, and it is in course of extension from Santa Isabel to Banapu, following the course of the railway.—*Industria e Invenciones.*

Stockport.—The local branch of the Amalgamated Society of Telephone Employés has decided to send a resolution to the Postmaster-General urging the payment of the war bonus granted from March 1st last.

Telegraph Plot.—The *Times* mentions the reported discovery of a German plot to seize Vancouver and other Pacific coast cities at the beginning of the war; it is stated that it was planned to control the Pacific Cable and route to Vladivostok from Vancouver.

Wireless Experiences at Gallipoli.—The following abstract is from a letter received by the Marconi Co., and circulated by the *Wireless Press*, from a naval wireless telegraph station on the Gallipoli Peninsula:—"Times have been very exciting, and working wireless here is not quite the same as sitting in a comfortable Marconi room on board ship. Our instruments are in a dug-out on a hill side facing the sea, our living 'room' is next door. We are using a 5-KW. pack set, excepting that the engine and generator are mounted on a bed-plate instead of on the usual pack-saddle frame. It has been about the best working set it has been my fortune to use; we have had no trouble at all, except very minor forms, since we landed. Our main trouble is broken shafts; we broke the original steel shaft, and have since had to manufacture our own from wood, which, needless to relate, do not last very long. We have been under a continual shell fire all the time—shells varying in size from 18-pounder to 11-in. (probably from the *Goeben*). It is a more or less common occurrence to have our aerial shot away; in that case we do not stop outside to make neat splices, but tie knots in the wire and rush for cover again. The last time it happened a piece of shell made a hole right through the base of the mast and cut two stays. The mast is still standing however. We also had a new reel of aerial wire cut up into small pieces! There are four operators besides myself. I do not keep a watch, as I have to generally superintend the working of the station. When I get any spare time, which is not often, I take a trip to the trenches and fire a few shots at sandbags—all I could see of the Turkish position excepting dead Turks. My last voyage with the Marconi Co. was coming home with the Australian troops. I have met them all here since and renewed many friendships."

CONTRACTS OPEN and CLOSED.

OPEN.

Aberdare.—September 8th. Supply of electrical stores, for the directors of the Powell-Duffryn Steam Coal Co., Ltd. Forms of tender from the Stores Manager, Aberaman offices, near Aberdare.

Australia.—ADELAIDE.—October 6th. Portable direct-coupled internal combustion engine and dynamo; extension to storage batteries at Central Exchange, for Deputy P.M.G.*

BRISBANE.—October 6th. Tinned-copper wire, porcelain pothead insulators, for the P.M.G. See "Official Notices" August 20th.

SYDNEY.—September 23rd. Condensers, galvanometers, relays, and sounders, also incandescent electric lamps, for the P.M.G.'s Department. See "Official Notices" August 13th.

October 25th. Six electrically-operated wharf capstans, for the Sydney Harbour Trust. Forms of tender from the Engineer-in-Chief, Harbour Trust Offices, Circular Quay.*

October 25th. For the Commonwealth Department of Defence (Navy Office). Supply, delivery and erection of power-station plant and equipment for the Commonwealth Naval Dockyard, Sydney.*

City Council. Turbine oils; motor or rotary converter for Town Hall sub-station; feed-water heater for power house.

HAWTHORN.—November 30th. Refuse destructor plant, for the Hawthorn-Malvern-Camberwell and Kew Destructor Trust. Specification from the Trust Engineer's Office, Town Hall.

Birmingham.—September 4th. Corporation. 250,000 tons of coal, for the Electricity Supply Department. Particulars from Mr. R. A. Chattock, City Electrical Engineer.

Edinburgh.—October 4th. Corporation. Cast-iron intake shaft, pump shaft, and connecting tunnel for obtaining sea-water for condensing in connection with the new electricity station at West Bank, Portobello. Specifications can be seen at the office of Sir A. B. W. Kennedy, 17, Victoria Street, S.W., and obtained from the Engineer, Dewar Place station, Edinburgh.

Kirkcaldy.—September 6th. Installation of electric light at the new Sanatorium and Fever Hospital buildings. Specifications, &c., from the Burgh Electrical Engineer.

London.—BOW.—September 21st. Supply of electrical goods, for the managers of the Poplar and Stepney Sick Asylum District. Forms of tender from Mr. S. G. Wright, Clerk, the Asylum, Devon's Road, Bow, E.

ISLINGTON.—September 7th. Six months' supply of electrical fittings and sundries, for the Guardians of St. Mary's, Islington. Particulars from Mr. E. Davey, Clerk, Guardians' offices, St. John's Road, Upper Holloway, N.

Manchester.—September 7th. Block tin, for the Tramways Committee. Mr. J. M. McElroy, General Manager.

New Zealand.—DUNEDIN.—November 3rd. City Council. Supply and delivery of insulated and bare copper wire in quantities for a period of two years. Specifications at Electrical Engineer's office, Market Street, Dunedin.—*New Zealand Shipping and Commerce.*

Reigate.—September 13th. T.C. Twelve months' supply of A.C. induction motor meters. See "Official Notices" to-day.

Shanghai.—September 24th. Municipal Council. One turbo-generator, 5,000 KW., and one or two of 10,000 KW., complete with condensing plant, &c. See "Official Notices" August 20th.

September 29th. E.H.T. switchgear, static transformers, and underground cables for 22,000 V., for the Municipal Council. See "Official Notices" August 27th.

South Africa.—JOHANNESBURG.—September 25th. For the T.C. Two turbo-alternator sets, condensing plant, switchgear, &c. Specification, &c., on deposit of £2 2s., from Mr. J. H. Dobson, General Manager.*

September 25th. Municipal Council. 1,595 electricity meters and 50 time switches.*

October 9th. Municipal Council. Water-purifying plant with a capacity of 75,000 gallons per 24 hours, for the generating station.*

Spain.—September 15th. The municipal authorities of Avila are inviting tenders for the concession for the electric lighting of the town during a period of 10 years, with a possible extension to 15 years.

Swindon.—September 18th. Corporation. Supply of steam coal. See "Official Notices" to-day.

Specifications for the items marked * can be seen at the Board of Trade Commercial Intelligence Branch in London.

CLOSED.

Australia.—The Hawthorn Tramways Trust has accepted a tender for the construction of the Melbourne-Burwood electric tramway, but the name of the successful firm and the amount had not been announced when our information left by the mail.

SYDNEY.—The City Council has accepted the following tenders:
Australian General Electric Co.—Disconnecting switch and fuses, £1,524.
N. Guttbridge & Co.—Indoor transformers.
W. G. Watson & Co.—Low-tension straight-stem insulators.

Belfast.—At a statutory meeting of the Belfast Harbour Commissioners on August 17th, the minutes of the Works Committee showed that a report had been made by the engineer as to Messrs. Alexander Chaplin & Co.'s contract for four 5-ton electric gantry cranes. The engineer was authorized to negotiate with Messrs. Chaplin for the completion of the contract on the lines suggested in his report.

Bristol.—The Docks Committee of the T.C. has accepted the tender of Messrs. Buchanan & Co. for the electric light installation at the new sheds at the Royal Edward Docks.

Coatbridge.—Messrs. Chamberlain & Hookham, Ltd., have received the contract for meters for the ensuing 12 months.

Coventry.—The T.C. Electric Light Committee has provisionally accepted the tender of the British Thomson-Houston Co., Ltd., for a 6,000-KW. set, and that of Messrs. Babcock & Wilcox, Ltd., for four boilers, for the electricity works.

Horsham.—The Council has accepted the tender of the Pritchett & Gold and Electrical Power Storage Co., Ltd., for the battery extension to which reference was made on page 261 of our last issue.

Reigate.—The B. of G. has accepted the tender of Messrs. Tamplin & Makovski for laying an electric light cable and a power cable from the transformer chamber, near the entrance lodge, to the switchroom in the basement of the new infirmary.

New Zealand.—NAPIER.—The tender of Messrs. Turnbull & Jones has been accepted for the installation of the electric light at the breakwater, at £320.—*New Zealand Shipping and Commerce.*

Salford.—The Electricity Committee has accepted the tender of Messrs. J. Gerrard & Sons, Ltd., for alterations and additions to buildings and the construction of foundations at the electricity station, Frederick Road, Pendleton, required in connection with the additional 5,000 KW. turbo-alternator, for £1,341. The following tenders have been accepted for the supply of coal during the 11 months ending July 31st, 1916:—

Clifton & Kersley Coal Co., Ltd.—16,000 tons of best washed slack, at 17s. per ton.
A. Knowles & Sons, Ltd.—8,000 tons of best washed slack, at 17s. per ton.
Earl of Ellesmere.—6,000 tons of best washed slack, at 17s. 6d. per ton.

FORTHCOMING EVENTS.

British Association.—The Manchester meetings will commence on Tuesday, September 7th, when Prof. Schuster will deliver his Presidential Address in the evening, in the Free Trade Hall. The concluding meeting will be held on Saturday morning, September 11th. Some of the papers to be read at the meetings are mentioned on page 214 of our issue of August 13th.

Institute of Marine Engineers.—Tuesday, September 7th, at 7 p.m. Presidential Address by Sir Arch. Denny, Bart., LL.D.

NOTES.

Electrical Company Heavily Fined.—On Tuesday last, at the Bow Street Police Court, the Concordia Electric Wire Co., Ltd., of Cricklewood, was fined £250, and 25 guineas costs, and two of the directors—Robert Fifer, of Hampstead Garden suburb and Leopold Aron, of Wembley, were fined £250 each, the company for failing to give the Public Trustee particulars of all the shares of the company held for the benefit of an enemy, and the two directors for being parties to the default. The information was concerning 13,993 shares held for the benefit of the Fabrik für Drahter zu Elektrischen Zwecken Vorm, of Aldershof, near Berlin, and the proceedings were taken under the Trading with the Enemy Act. Mr. Travers Humphreys appeared on behalf of the Director of Public Prosecutions. According to the report in the *Daily Telegraph*, he stated that the company was registered in 1902 for the purpose of trading as a branch of a German company called the Fabrik für Drahter zu Elektrischen Zwecken Vorm, of Aldershof, near Berlin. The whole of the share capital was held by persons in England in trust for the parent company; the company was managed from Berlin, and the profits were remitted to Berlin. At the outbreak of war the subscribed capital of the company consisted of 14,000 £1 shares, of which 13,988 were held by the two directors Aron and Fifer, as nominees for the enemy alien concern in Germany. In May of this year Aron seemed to have got a little nervous about his position, he was expecting to be interned, and desired to get rid of his shares. He therefore approached two employés of the company, and suggested that they should each take half of his 7,988 shares. Neither of them was in a position to buy the shares, but they each gave a promissory note for £1,000, and an arrangement was made that as dividends were declared on the shares the money should be taken by Aron. So far as Fifer was concerned, he still held 6,000 shares as nominee for the parent company. No notice was sent to the Public Trustee of these enemy shareholdings, and probably the matter would never have come to the knowledge of the authorities but for an accidental circumstance. It happened that a woman was summoned at the police-court for the non-payment of rates. She mentioned that her husband had been employed by this company, which she referred to as a German company in a way which caused the police to make inquiries. Detective-inspector Ferrier went to the office and saw Aron, who made a clean breast of the whole matter, and subsequently the necessary return was made, showing that all the share capital was held on behalf of the German company. The books of the company showed that for the year 1913 a profit of £3,294 was remitted to Berlin, and up to September, 1914, there was a profit of £2,292, which was invested in English securities. He was instructed to put the case before the Court as one in which there were no mitigating features.

Mr. Elliott, for the defendants, said his clients were unaware of the provision of the Act of Parliament which required these returns to be made. Since the outbreak of war no money had been transmitted to Germany, and there had been no act inimical or hostile to this country. The company was a prosperous one, which had been executing contracts for the Government in connection with the supply of wire for telegraphs and telephones. The defendants were both paid servants of the company, and had no further interest in the business. Aron was now interned, and Fifer, who was the son of Russian parents born in Berlin, was naturalised in this country.

Mr. Hopkins (the Magistrate) said that to tell him that two foreign directors of a foreign company did not know their liabilities under this statute was to tell him that which no amount of persuasion would make him believe.

Private Arrangements.—Phœnix Electric Heating Co. (1914), Ltd., electrical engineers, 17, Morwell Street, Tottenham Court Road, London, W.—In pursuance of the Companies' (Consolidation) Act, a meeting of the creditors of the above was held on Wednesday, when it was reported that the company had passed resolutions in favour of voluntary liquidation. The liquidator stated that the company was registered in September, 1914, with a nominal capital of £3,000 in £1 shares, to take over the business of manufacturers and dealers in electrical apparatus, which had previously been carried on by Mr. S. D. Cox, under the style of the Phœnix Electric Heating Co. The company took over the business as from January 1st, 1914, and the purchase price of the assets transferred was £750, which was satisfied by the allotment to the vendor of fully-paid shares. The company also gave the vendor an undertaking to fulfil all contracts and indemnify him against any claims. The directors of the company were Mr. S. D. Cox and Mr. B. L. Clements, and they each held 751 shares. The total number of shares issued was 1,503, and on the shares held by Mr. Clements there was a liability due to the company of about £240. In 1914 the company made a loss of £458. That loss was chiefly attributable to a strike which took place. During the present year there had been a further loss on the trading, owing chiefly to lack of working capital. Work in hand could not be carried out for that reason. The company had a contract with the Admiralty, but the proceeds of the contract had been assigned to the bank, who were creditors for about £200. The landlord had distrained for rent, and was still in possession. The liquidator could not see his way to advance the money to pay out the landlord, and unless the business could be sold as a going concern the landlord would sell the assets, and there would probably be nothing for the creditors. The liabilities of the company amounted to between £600 and £700, while the only free asset consisted of the book debts, which were estimated to realise £60 or £70. The other assets were office furniture, plant and tools valued in the books at £200, and stock-in-trade £300. At a forced sale the stock and plant would not produce anything like the figure at which it appeared in the books, and might not produce sufficient to satisfy the landlord's claim. Efforts were being made to sell the business as a going concern. No resolutions were passed, and therefore the voluntary liquidation of the company will be continued with the liquidator appointed by the shareholders.

Institution and Lecture Notes.—Iron and Steel Institute.—At the autumn meeting, which is to be held at the Institution of Civil Engineers, Great George Street, S.W., on Thursday and Friday, September 23rd and 24th, Mr. Arthur Cooper, LL.D. (immediate Past-President) will preside, in the absence of Mr. Greiner. The following is the list of papers that are expected to be submitted for reading and discussion:—

Wesley Austin, M.Sc.: "Influence of Oxygen on Some Properties of Pure Iron."
T. H. Byrom: "Note on the Carburisation of Iron at Low Temperatures in Blast Furnace Gases."
Prof. E. D. Campbell: "Influence of Heat-Treatment on the Specific Resistance and Chemical Constitution of Carbon Steels."
Prof. C. A. Edwards, D.Sc., and H. Kikkawa: "Effect of Chromium and Tungsten upon the Hardening and Tempering of High-Speed Tool Steel."
W. H. Hatfield, D.Met.: "Phosphorus in Iron and Steel."
Prof. K. Honda and H. Takagi: "The Magnetic Transformation of Cementite."
R. H. Smith: "Sulphur in Malleable Cast Iron."
Prof. N. Tschischewski: "Iron and Nitrogen."

By-laws.—As Rule 20 requires that no alterations of the by-laws shall be made except at the annual general meeting, and notice of any proposed alterations shall be given at the general meeting to be held in the autumn, the Council will, at the forthcoming meeting, give formal notice of their intention to submit to the annual meeting in May, 1916, the following new rules for addition to the existing by-laws:—

1. In the event of a state of war existing between Great Britain and any other country, or State, all members, honorary members, and honorary vice-presidents who shall be subjects of such enemy country, or State, shall forthwith cease to be members, honorary members, or honorary vice-presidents of the Institute, but they may, if the Council thinks fit, be reinstated after the termination of the war.
2. The Council shall have absolute power to remove from the list of Members of the Institute the name of any member, whether ordinary or honorary, for wilful contravention of the by-laws or for any other reason which seems to them sufficient, and such ordinary or honorary member shall thereupon cease to be a member of the Institute.

Institution of Mining Engineers.—At the annual meeting, which takes place at Leeds on September 15th, several papers will be read, including one by Mr. Sam Mavor on "Compressed Air for Coal-Cutters," and one by Mr. M. H. Mills on "Gas Producers at Collieries for Obtaining Power and By-products from Unsaleable Fuel."

Royal Engineers (Wireless Section).—There are several commissions available in the Wireless Section of the Royal Engineers for general service during the period of the war. Applications are invited from candidates with good technical knowledge of wireless telegraphy and used to the control of men. Applications should be addressed to Major Handley, M.I.E.E., O.C., Wireless Training, Oxford Cottage, Sandown, I.W.

Fatality.—A seven-year-old child was killed by electric shock on the North-Eastern Railway Riverside Branch while trespassing. He climbed over the wall on to the railway, and was found with his face, fingers and knees in contact with the live rail. On July 21st a boy of 11 was prosecuted for trespassing at the same place.

Educational.—King's College, University of London, Faculty of Engineering.—Next term begins on October 6th. Particulars are given in our advertisement pages.

Electrically-driven Letter-Sealing Machine.—H.M. Trade Commissioner for New Zealand reports that one of the New Zealand Government Departments makes inquiry for the names of United Kingdom manufacturers of electrically-driven letter-sealing machines. The device at present being used is of foreign manufacture, is self-feeding, and is stated to work much more rapidly than any hand or treadle machine. At the same time it is apparently not so durable as could be wished, and no spare parts are obtainable. Communications should be addressed to H.M. Trade Commissioner for New Zealand, P.O. Box 369, Wellington, New Zealand.

Shirkers Fined.—We observe that some 23 youths engaged at the works of Messrs. Stewarts & Lloyds have been fined for leaving their work because of the heat of the tube-welding furnaces. Their action stopped three furnaces, put 22 men out of work, and wasted 20 tons of metal. A reminder that our men at Gallipoli and in Persia were having a far hotter time failed to influence them. The chairman of the Bench at Halesowen said that our men were fighting up to their knees in water, and probably required these tubes for draining the trenches.

Volunteer Notes.—ENGINEERING INSTITUTIONS' VOLUNTEER TRAINING CORPS.—Headquarters, Marconi House, Strand, London, W.C. Drill Centre.—By kind permission of Lieut.-Col. A. E. Le Rossignol, R.E., Headquarters of London Electrical Engineers, 46, Regency Street, London, S.W.

Company Orders.—By Lieut.-Col. C. B. Clay, V.D., Commandant, for week ending September 11th, 1915 :—

Monday.—Drill, 6.30-7.30 ; 7.30-8.30. Section 3, Technical instruction ; Section 1, musketry at the miniature ranges ; Sections 2 and 4, Squad drill.

Friday. — Drill, 6.30-7.30 ; 7.30-8.30. Section 4, Technical instruction ; Section 2, musketry at the miniature ranges ; Sections 1 and 3, Squad drill.

Signalling.—It is proposed to form a signalling class, and the names of those wishing to join should be given at once to the Section Commanders.

Good progress is being made with the Training Corps both in drill and in the technical work for which the Corps is specially preparing itself.

Arrangements have been made for the use of a rifle range, and members can attend not only at the hours of drill, but at any time convenient to themselves, for practice, instructors being in attendance and rifles provided.

There are still vacancies for recruits, either among those attached to the Engineering Institutions or others to whom the technical work of the Corps appeals.

Applications should be made to Lieut.-Col. C. B. Clay, V.D., the Commandant of the Corps, at Marconi House, Strand, W.C.

3RD BATT. (OLD BOYS) CENTRAL LONDON REGIMENT (VOLUNTEERS).—Battalion Orders by Colonel S. G. Grant (Officer Commanding), Thursday, September 2nd, 1915 :—

Captain of the Week, Mr. W. Ridd ; Orderly Officer, Mr. C. S. George.

Week-end Parades.—Saturday.—The Battalion will parade at Liverpool Street Station (low level entrance G.E.R.), at 1.50 p.m., for entrenching purposes. Dress : Uniform complete with brassard. Arms will not be carried. The Battalion will return at 6.42 p.m.

Sunday, 7 a.m., Réveillé ; 10 a.m., Church Parade ; 10.20 a.m., Battalion Parade (Bridging) ; 10.30 a.m., Sketching Class only for those detailed ; 2.30 a.m., Bridging.

Resignations.—The following members have resigned their membership :—C. G. Botting, S. W. Carey, H. W. Saunders.

Musketry.—The names of men of "A" Company who are members of a club shooting at Bisley, but are not on the list of those entitled to shoot on the Corps targets at Bisley, to be sent at once to the Second-in-Command.

There will be firing at both Acton and Bisley Ranges on Saturday next, the 4th inst. Men who have sent in their names will parade at the usual times.

Test Paper.—All answers to the Test Paper to be sent to the Second-in-Command of "A" Company by the 10th inst.

A. G. JOINER, *Captain and Adjutant.*

Appointments Vacant.—Junior switchboard attendant (24s.) for West Bromwich Corporation ; shift engineer (45s.) for Beckenham U.D.C. ; leading fireman (37s. 6d.) and switchboard attendant (35s.), for Stockport electricity department. Particulars are given in our advertisement pages.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—MR. W. EASTWOOD, of Halifax, has been appointed second assistant at the electricity works of the Hebden Bridge U.D.C.

General.—MR. PARKER, electrician, 2A, Ashworth Street, St. Mark's Road, Leeds, having joined the Army, has discontinued his business.

MR. HARRY H. SHEPPARD, for many years in charge of the armature shop of the Sheffield Corporation, has resigned, having accepted a position with Messrs. C. A. Vandervell & Co., electrical engineers, London.

A Central News dispatch from New York states that MR. T. A. EDISON is suffering from an injury to his eyes which he received while making experiments with potash.

We learn that MR. J. B. TUCKER, of Messrs. J. H. Tucker & Co., Birmingham, has just been given a commission in the Royal Engineers.

Roll of Honour.—Private J. WILCOCK, of the 2nd Battalion South Lancashire Regiment, who has been killed in action at St. Eloi, had been employed for seven years at the Warrington electricity works. He was 38 years of age.

Private SAMUEL BARDSLEY, of the 1/5th Battalion Lancashire Fusiliers, formerly employed at the Heywood electricity works, has been wounded at the Dardanelles. He was 21 years of age.

A New Zealand paper says that Private H. P. HOPKINS (Canterbury Battalion), killed in action at Gallipoli, was an electrician in the Tramway Board's service, which he entered in February, 1914.

The Military Cross has been awarded to Temporary Second-Lieut. GEORGE WHELDON WANSTALL, Royal Engineers, for conspicuous gallantry on several occasions during the operations on the Gallipoli Peninsula, especially on June 19th, 1915, when he successfully repaired the telegraph lines, with the assistance of three men, making 35 joints in a space of 150 yards, whilst under heavy shell fire. Lieut. Wanstall performed similar valuable service on July 5th and 7th, on all occasions under shell fire.

Rifleman ALBERT GOLDING, King's Royal Rifles, who was electrician at the Hotel Metropole, Whitby, has died from wounds received in action in France. He joined the regiment last October, and went to the Front in May.

Sapper G. N. HALLIWELL, of the 1st Field Company, East Lancashire Royal Engineers, formerly employed at the British Westinghouse works at Trafford Park, has been killed in action at the Dardanelles.

Rifleman FREDERICK LEE, of the 8th Battalian Rifle Brigade, who was on the staff of Messrs. Willans & Robinson, Ltd., electrical engineers, of Rugby, has been killed in action. He enlisted on September 7th, and went to the Front after his marriage on April 28th.

The *Times*, in referring to the death of Second Lieut. HENRY GWYN-JEFFREYS MOSELEY, M.A., of Trinity College, Oxford, which occurred at the Dardanelles on August 10th, states that after taking his degree in the Natural Science School (Physics), he was appointed Lecturer and Demonstrator in Physics, under Prof. Sir E. Rutherford, in the Victoria University, Manchester. "There, after two years, he was awarded the John Harling Fellowship for Research. On returning to Oxford he continued his work of research in Prof. Townsend's laboratory. His numerous publications treat chiefly of radio-activity and X-rays, and his latest work on the high-frequency spectra of the elements led him to important conclusions on the structure of atoms and the number of the elements, an achievement by which he will be best known. The early death of this brilliant young physicist is a great loss to science. At the outbreak of the war he was in Australia, but returned to England at the first opportunity, and was at once given a commission in the Royal Engineers."

Sergeant ALFRED P. F. VEITCH, of the 1/6th Battalion Manchester Regiment, formerly employed at the British Westinghouse works at Trafford Park, who has been twice wounded in the war, is this week officially reported to have died from wounds. He had been serving for some time in the Dardanelles.

Sapper J. BRODERICK, of the Royal Engineers, East Lancashire Division, who has been killed at the Dardanelles, resided in Manchester, and was an electrical engineer. He was 26 years of age.

Obituary.—The death occurred last week of MR. HAROLD CAMPBELL, of Warrington, who had for five years past been connected with the St. Helens Cable and Rubber Co., Ltd. After serving at the Warrington works for some time he went to London for about a year as a representative of the firm, and subsequently he returned to Warrington as an assistant departmental manager. He was only 23 years of age. At the funeral on Thursday last week representatives of the St. Helens Cable Co. acted as bearers, and floral tributes were sent by the staff, the London office staff, and the office girls.

The death took place on Thursday, August 26th, at 78, Chapel Lane, Headingley, Leeds, of MR. ALFRED BEAUMONT, electrical and mechanical engineer. The deceased gentleman was 68 years of age.

The death has taken place of MR. HERBERT MITCHELL, formerly in business as electrical engineer at Brockholes, Huddersfield, and lately residing at Weymouth. Deceased met with an accident while cycling and died from the injuries he received.

We regret to note that the death occurred on August 28th, at 109, Ladbroke Grove, W., of MR. HENRY CROOKES, A.R.S.M., M.I.E.E., F.C.S., in his 57th year. Mr. Crookes was the eldest son of Sir William Crookes, O.M., president of the Royal Society.

Will.—The late Baron H. DE REUTER left £39,442 gross and £33,371 net personalty.

NEW COMPANIES REGISTERED.

Milton Accumulators, Ltd. (141,409).—This company was registered on August 27th, with a capital of £1,000 in £1 shares, to carry on in the United Kingdom or elsewhere the business of manufacturers, builders, repairers, constructors, designers, importers and exporters of accumulators, motors, motor and other cycles, and all accessories and appliances relating to motoring, conductors of schools of instruction for motoring, constructors of hangars and other buildings, aeroplanes and flying machines, and accessories and appliances relating to aerial navigation, aeronautical, mechanical, electrical and motor engineers, etc. The subscribers (with 250 shares each) are : M. Wolff, 9-15, Whitecross Street, E.C., merchant; A. J. Mardlin, 84, Milton Street, E.C., merchant. Private company. The number of directors is not to be less than two or more than five; the first are M. Wolff and A. J. Mardlin (both permanent). Qualification, 100 shares. Registered office : 84, Milton Street, E.C

Whipp and Bourne, Ltd. (141,413).—This company was registered on August 27th, with a capital of £35,000 in £1 shares, to take over the business carried on at Switch Gear Works, Castleton, Rochdale, as Whipp & Bourne, to carry on the business of switch gear makers, electricians, mechanical engineers manufacturers and workers of and dealers in electricity, motive power, light and heat, etc., and to adopt an agreement with S. Whipp, C. W. D. Bourne and F. Whipp. The subscribers (with one share each) are : S. Whipp, Derrynane, Castleton, Rochdale, electrical engineer; C. W. D. Bourne, Sparthfield Avenue, Rochdale, electrical engineer; F. Whipp, Bamford Cottage, Bamford, Rochdale, electrical engineer. Private company. The number of directors is not to be less than two or more than five; the first are S. Whipp, C. W. D. Bourne, and F. Whipp (all permanent managing directors, subject to holding not less than 5,000 of the shares allotted to them under purchase agreement). Qualification of other directors, 100 ordinary shares. Solicitor : J. A. Hudson, The Butts, Rochdale.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Hong-kong Tramway Co., Ltd.—A memorandum of satisfaction to the extent of £500 on July 19th and £100 on August 3rd, 1915, of trust deed dated July 1st, 1903, securing £195,000, has been filed.

Pitter's Ventilating and Engineering Co., Ltd.—Land Registry Charge, Charge, and Assignment of Contract on lands and premises in Woolwich and certain moneys, all dated August 6th, 1915, to secure all moneys due or to become due from company to London and Provincial Bank, Ltd., 3, Bank Buildings, Lothbury, E.C.

Direct United States Cable Co., Ltd. (11,597).—Capital, £1,300,000 in £10 shares. Return dated May 11th, 1915. 121,420 shares taken up; £1,214,200 paid. Mortgages and charges: Nil.

London Aluminium Co., Ltd.—Mortgage, dated August 12th, 1915, to secure £3,350, charged on certain land and premises at Witton, Birmingham. Holders: W. J. Halsey, Ray Lodge, Maidenhead; and A. A. Barnard, The Wilderness, East Molesey.

Bude Electric Supply Co., Ltd. (95,137).—Capital, £15,000 in £1 shares. Return dated May 1st, 1915. 10,000 shares taken up; £10,000 paid. Mortgages and charges: £2,500 mortgage debentures.

CITY NOTES.

Electric Supply Co. of Victoria, Ltd.

The directors, in their report for the year ended March 31st, 1915, give the following comparative statement of the figures for the past three years:—

LIGHTING DEPARTMENTS—Lamps Connected.

1912-13.	1913-14.	1914-15.
107,108	130,357	150,132

TRAMWAY DEPARTMENTS—Passengers Carried.

1912-13.	1913-14.	1914-15.
5,707,842	5,566,470	5,177,368

TRADING ACCOUNT—Receipts and Expenditure.

	1912-13.	1913-14.	1914-15.
Revenue	£87,088	£89,024	£86,800
Expenditure	57,922	57,524	56,990
Gross profit	£29,165	£31,500	£29,810

The trading profits show a decrease, which is accounted for by the abnormal conditions which have prevailed for the past nine months of the financial year. A very serious drought, lasting about seven months, was experienced in Victoria, resulting in a serious depression of the general trade of the colony. The present war has seriously affected the receipts from the tramways in Ballarat and Bendigo, as is the case in other large cities in Australia, enlistment of the population having affected the traffic receipts. The balance to the credit of profit and loss account, including £3,626 brought forward, and after deducting debenture interest paid and amount transferred to debenture stock redemption account, is £17,524. It is proposed to pay on account of arrears of preference dividend £14,659, to write off discount and commission on debenture stock account £865, and to carry forward £2,000. The annual meeting was held at Liverpool on August 25th.

Brazilian Traction, Light and Power Co., Ltd.

The report for 1914 (as abstracted in the *Financial Times*) states that a few of the outstanding shares of the Rio de Janeiro Tramway, Light & Power Co. and the Sao Paulo Tramway, Light & Power Co. were acquired, and a large controlling interest was secured in the Companhia Rede Telephonica Bragantina, a telephone company carrying on business throughout the State of Sao Paulo. This was a very desirable acquisition, having in view the telephone business carried on by the Rio de Janeiro Tramway, Light & Power Co. through the Rio de Janeiro and Interurban Telephone Companies. This investment was made without the necessity of providing cash for the purpose, the Bragantina shares being acquired on the basis of the purchase price being satisfied by the issue of fully-paid ordinary shares of this company's capital stock. The company has also acquired an important interest in the Cia Telephonica do Estado de Sao Paulo. The total share capital of this company issued on December 31st, 1914, was $116,217,500, divided into 1,062,175 ordinary shares of $100 each and 100,000 six per cent. cumulative preference shares of $100 each. The year has been one of general business depression in Brazil on account of the local conditions, both financial and commercial. The outbreak of the European war had the effect of stopping the usual method of remittances by means of bills of exchange, and for several months it was practically impossible to remit money from Brazil for the purpose of the payment of coupons and dividends. As this situation did not improve, the board decided in October to remit its funds—which by that time had accumulated to a very large amount—in coffee, as they felt that this method of remittance was a sound and safe procedure, and one which, under the circumstances, should prove satisfactory. As the Rio de Janeiro Tramway, Light & Power Co. has under charter a fleet of steamers for the purpose of carrying the coal and other material required by the companies in Rio de Janeiro and Sao Paulo, the board employed these on their return journeys for freighting the coffee purchased in Brazil to the New York and European markets, and as coffee is a staple product in commerce, it offered a safe and, at that time, the only practical means of remitting the company's funds. Up to the end of the year there had been purchased and shipped from Rio de Janeiro and Santos 278,400 bags of coffee, to the value of 11,695 contos of reis, all of which has since been disposed of in New York at prices which have enabled the company to net an average of 13 54-64d. per milreis, which is materially in excess of the average rate of exchange during the same period, even if it had been possible to buy bills for such a large amount of money. The result of the company's operations for the year have not been as satisfactory as anticipated. As a result of the monetary stringency and other adverse conditions in Brazil, the factories began to run on short time or suspend business completely, and with the large number of employés thrown out of work, due to the cessation of commercial activity, the earnings of the tramway systems in Rio de Janeiro and Sao Paulo were seriously affected, but, notwithstanding such bad business conditions, the gross income of the combined companies in Brazilian currency has shown an increase over the previous year. The revenue in gold has, of course, been unfavourably affected by the drop in exchange. The revenue from securities owned and under contracts with subsidiary companies amounted to $7,523,695 and interest on advances to subsidiary companies $535,117, together $8,058,813. General and legal expenses, administration charges and interest on loans were $392,280, leaving a surplus available for dividends of $7,666,532. Dividends Nos. 4, 5, 6 and 7 on six per cent. preference shares at 1½ per cent. each absorb $600,000, and Nos. 6, 7, 8 and 9 on the common shares at 1½ per cent. each $6,257,119, leaving surplus carried to profit and loss $809,412. After payment of the regular dividend of 6 per cent. per annum on the ordinary shares a credit balance of $3,822,410 has been carried forward. In view of the serious financial conditions developing in Brazil, and later the much more serious financial situation throughout the world, all possible expenditures on capital account in connection with the development of the property were suspended, but there was a large amount of work under way which it was necessary for the different subsidiary companies to complete. A considerable amount of construction work had also to be carried out in order to comply with the obligations of the different concessions. In this connection the different companies have performed all of the necessary work, both for capital account and as regards maintenance and renewals. Mr. Alexander Mackenzie has been appointed to fill the vacancy caused by Dr. Pearson's death. Appended to the directors' report is one drafted by the late Dr. Pearson on the operations and finances of the subsidiary companies during the year 1914. This report was prepared by him while on the *Lusitania*, and has been adopted by the board, with such additions and changes as seemed necessary. It was found in his pocket after the recovery of his body, and represents, therefore, his last work for the company.

Quarterly dividend of 1½ per cent. on fully-paid cumulative preference shares is payable on October 1st.

Manaos Tramways & Light Co., Ltd.

Mr. Geo. Watson presided over the annual meeting held on Tuesday at the offices, 9, Cloak Lane, E.C. In moving the adoption of the report, he referred to the absence of the Chairman of the Company (Mr. Geo. Booth), who, he said, was devoting the whole of his time to the service of the country in organising the supply of munitions. The revenue account showed that the tramway receipts were £68,992, as against £87,028 in the previous year, a reduction of over 20 per cent. The operating expenses were £61,029, against £71,031, a reduction of 14 per cent. The lighting receipts amounted to £40,397, against £44,395, and the expenses to £22,436, against £24,684. Both receipts and expenses showed a reduction of about 9 per cent. The revenue from construction and supply was £1,030, against £1,453, a reduction of over 29 per cent., and the expenses to £774, against £1,133, a reduction of nearly 32 per cent. The total receipts amounted to £110,420, against £132,877, a reduction of about 17 per cent., and the expenses to £84,240, against £96,848, a reduction of about 13 per cent. The result was that they carried £26,180 to profit and loss account against £36,028 last year, a reduction of £9,848, or just over 25 per cent. The reduction in the total receipts of about 17 per cent., and in the total expenses of about 14 per cent., showed, according to general experience, a very reasonable and satisfactory proportion. Whilst the revenue of a company like theirs depended so much upon local conditions—sometimes beyond the control of the directors—the expenses could be cut down, but only to a point where further reduction would prejudice the efficiency. He thought they would agree that the figures he had given indicated that the management had kept careful watch on the expenditure, and had succeeded in reducing it to a reasonable proportion of the total revenue, and from the fact that they had received no complaints regarding the efficiency of the service, they might take it that the reduction in expenditure had not been carried beyond the legitimate limit. He would go further, and say that the directors had always kept in view their obligations under their contract with the Government in that respect, and the cordial relations which existed between the company and the Government proved that they believed the company had so far carried out, and would continue to carry out, loyally the spirit of its contract. In the profit and loss account they would find interest on loan and

office expenses stated separately. The interest on the loan amounted this year to £1,615, as against £1,271 last year, and the office expenses to £1,452, as against £2,790 last year; a very considerable reduction. The loss on exchange was £6,180, as compared with £212 last year, which was a very serious matter. The Chairman commented at some length on the question of exchange, which, he pointed out, was a very important matter in a company like theirs, in which the revenue was all practically in currency, but where there was a considerable sterling obligation for interest on bonds. He thought, however, that Brazil was in a stronger position to resist a serious fall in exchange than it was years ago. It would be generally admitted that the result of the year's operations was disappointing, but the general prosperity of Brazil had, on the whole, been at a low ebb owing to the low price of rubber, the general financial crisis, and the European war. People had received less money, and many who had enjoyed the luxury of riding on their tramcars had to be content with walking. The only consolation they had for such enforced economy was the hope that it would be ultimately for the good of the people, and that when normal times returned to this enormous district money would be wisely spent in developing the country, so that it would not have to depend so much upon a single product. So that his remarks might not be too depressing, he might say they had had some encouraging results from the extensive experiments they had made in regard to fuel. As they would realise, this item of expenditure had been seriously affected by the present conditions. They had made an effort to burn local wood fuel as far as possible, and the results had been so successful that they were now using wood fuel exclusively, and only maintained a stock of coal against any possible shortage of wood. This change of fuel had benefited the company in several ways. The cost was much less than coal; it was paid for in currency instead of in sterling, and, therefore, the loss in exchange in their heaviest item of expenditure was saved; and it also circulated money locally, which helped towards maintaining their tramway and lighting business. Another encouraging fact was with regard to their account against the Government for lighting. For many years they had had a large claim against the Government, which on April 30th, 1915, amounted to £37,637, which would pay off their present loan and leave a considerable margin in hand. During the year under review the directors considered that, as the revenue of the company was decreasing to such an alarming extent, some special endeavour should be made to make the Government realise the position, and, after considerable negotiation, they succeeded in getting an exchange of accounts last January whereby the rental due by the company on that date was charged against the debt due to the company by the Government. They had received further consideration in the official pronouncement that for the present it would not be necessary for the company to provide cash against the payment of rental, and until certain things took place they would not be called upon to do so. This, of course, was only a provisional arrangement, but strong representations had been made to the Government to place the annual rental due by the company against the debt until such time as the Government was in the position to pay off the balance. They hoped the Government would see the justice of their claim, and that some permanent arrangement would ultimately be arrived at.

Mr. W. Burton seconded the motion, and it was carried.

STOCKS AND SHARES.

Tuesday Evening.

The second August of the war has affected Stock Exchange markets much less forcibly than the first one did. The latter had the effect of paralysing business, of laying as complete a check upon financial enterprise of all sorts as anybody in this generation has ever seen. For a few weeks, Stock Exchange markets were literally numb. Even negotiations came to something like a full stop. The only people who attempted to do anything were the bears, who saw their opportunity to replace stock at figures which showed them profits, the extent of which was only equalled by the heavy losses which they, the bears, incurred upon other securities that they happened to hold as bulls.

It was not until the end of the month that any kind of inquiry on the part of the public began to arise, whereas in these latter days there is still a quiet business being done which is, at all events, sufficient in extent to enable the realisation of a fair number of securities. The Stock Exchange is open; this time last year it was closed for five months. The competition which it was feared would arise, by reason of the Treasury restrictions imposed upon the House as a condition of its opening last January, has not materialised. The *Daily Mail* suspended its stock and share exchange last week, giving as its reasons for doing so, the stagnation of Stock Exchange business and pressure of war news upon its space.

The trouble in the coal trade would no doubt have had a most depressing effect upon Stock Exchange prices had the markets been in their normal condition. As things are now, the incomprehensible attitude of the miners will have far more influence, unhappily, upon war requirements than upon Stock Exchange securities. Electric lighting shares are dull, without being flat. Home Railway stocks have drifted back, until London & North-Western, for example, stands lower than it has done for half a century. Industrial companies, which are largely dependent upon their prosperity for an adequate supply of coal at reasonable prices, are not influenced as regards the prices of their stocks and shares. When sellers predominate, the dealers simply say so, declining to buy unless they know where to find support, but refusing, at the same time, to alter the nominal quotations of the securities. There are, be it understood, no official prices in the regular sense of those words, and so quotations can be left standing without the insistence of would-be sellers that these levels should be put down if stocks cannot be realised.

The position of the New York exchange continues to excite a lively and an anxious interest in financial circles. The popular proposal for remedying the unnatural state of affairs which has arisen, through the preponderance of imports into the United Kingdom from America over the exports sent across the Atlantic, is the floating of a British loan in New York. Wise and experienced brains are focused upon the problem; but, in the meantime, it is worth noticing how the rise in American railroad and industrial shares continues merrily. Were there to be a large British loan in New York offered at a tempting price, it would have the same effect upon American securities as the June War Loan had on stocks and shares over here, to wit, the lowering of existing standards, and the establishment of a new criterion by which investment yields would be judged. New York Telephone 4½ per cent. bonds are now just 100, whereas the British 4½ per cent. War Loan can be bought at 97¾.

With reference to bonds the interest on which is payable in London and New York, a curious position has arisen in connection with this fall in sterling exchange. Underground Electric income bonds are amongst those of this class, and the New York Telephone 4½ per cent. coupons can also be cashed in both cities. With the rate of exchange down to its present level, it pays a holder handsomely to send out coupons to New York and to receive from there a dollar cheque which he can convert, upon its return to London, into sterling. By this means, he can make about 4 per cent. of the coupon value additional; that is to say, the £3 Underground income coupon would realise, roughly, £3 2s. 6d. at to-day's exchange. Holders of big lines of stock have probably recognised this, and sent out their coupons to be collected on the other side, arguing that it is a morally legitimate transaction, inasmuch as the money has to be returned to this country, and spent here. Others, however, have an uneasy feeling that it is scarcely playing the game, although they have some difficulty in explaining their scruples. The exchange is likely to be rectified before long, so that the opportunity is scarcely likely to recur; but it is certainly a freakish outcome of the war, and worth mentioning, if only as a financial curiosity.

Electric Lighting shares, as already noted, are somewhat dull, and some of the issues which are quoted ex-dividend have given way rather more than the amount of the deduction. In the industrial group there is no particular change. Edison & Swan debenture went back 2 points to 58. British Westinghouse preference retain their rise. British Insulated ordinary are still on offer, but there are buyers about of the preference shares.

Eastern Extensions at 11½ are 10s. to the good, and a small inquiry for United River Plate Telephones advanced the price to some extent. Marconis have been keeping steady at a trifle under 2. On the other hand, American Marconis receded to 17s., in response to one of the spasmodic reactions in American industrials which occur every now and then to check the boomlet amongst "war specials." Canadian Marconis are steady at 6s. 1½d., and in other Marconi issues no movements have occurred.

Profound disappointment is felt at the inaction of the United States with regard to Mexico. The demonstration made at Washington two or three weeks ago, when a conference was summoned of representatives of the principal parties to the strife, has so far produced no result at all. Of news there has been practically none for a fortnight, and, in consequence, prices of bonds, stocks and shares connected with Mexico have fallen back to much the same levels as they occupied before hopes were raised by the calling of the Washington conference. Mexico Tramways 5 per cent. first mortgage bonds at 40 show another loss of 5 points; and while no quotable changes have occurred in the other securities—one feels rather that the last word ought to be put into inverted commas—the market in them is once more flat and inert.

Brazilian Tractions and most of the other issues connected with the country show a reactionary tendency, because the rate of exchange has dropped once more to a shilling. This may be due to gambling in sterling, but it has had the effect of restraining business, and there is not much doing in Brazilian Tractions at the moment.

Most of the copper shares are firming up again. The course of the market for the metal is more favourable to holders, and prospective buyers, who have been waiting for prices to touch bottom, are now hastening to pick up cheap stock. In the rubber market, prices are well held, and there is quite a fair amount of business going on amongst the investment shares. The armament group is steady, but quotations vary little from day to day, and even from week to week, demand and supply being on an unusually regular scale just now.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend, 1914.	Price Aug. 31, 1915.	Rise or fall this week.	Yield p.c.
Home Electricity Companies.				
Brompton Ordinary	10	7⅞ xd	—	£6 13 4
do. 7 per cent. Pref.	7	7⅞ xd	—	4 16 7
Charing Cross Ordinary	5	3⅜	— ¼	6 13 4
do. do. do. 4½ Pref.	4½	3⅜	— ¼	6 0 0
do. do. City Pref.	4½	3⅜	— ⅛	6 0 0
do. 4 Deb.	4	80	—	5 0 0
Chelsea	5	4⅜	—	5 14
do. 4½ Deb.	4½	88	—	4 17 10
City of London	9	12½ xd	—	7 7 0
do. do. 6 per cent. Pref.	6	10⅝ xd	—	5 11 4
do. do. 5 Deb.	5	100	—	5 0 0
do. do. 4½ Deb.	4½	85	—	5 6 0
County of London	7	10½	—	6 13 4
do. do. 6 per cent. Pref.	6	10⅝	—	5 14 8
do. do. 1st Deb.	4½	90	—	5 0 0
do. do. 2nd Deb.	4½	85	—	5 6 0
Kensington Ordinary	9	6½	—	7 4 0
London Electric	4	1⅜	—	8 3 4
do. do. 6 per cent. Pref.	6	4½ xd	+ ½	6 6 4
do. do. 4 Deb.	4	80	—	5 0 0
Metropolitan	3½	2½	— ½	7 0 0
do. 4½ per cent. Pref.	4½	3⅝	—	6 0 0
do. 4½ Deb.	4½	90	—	5 0 0
do. 3½ Deb.	3½	70	—	5 0 0
St. James' and Pall Mall	10	6⅜	—	7 8 2
do. do. do. 7 per cent. Pref.	7	6½	—	5 12 0
do. do. do. 3½ Deb.	3½	70	—	5 0 0
South London	5	2⅝	—	6 19 0
South Metropolitan Pref.	7	1 7/16 xd	—	6 14 0
Westminster Ordinary	9	6⅜	—	6 13 4
do. 4½ Pref.	4½	4½	—	5 9 0
Telegraphs and Telephones.				
Anglo-Am. Tel. Pref.	6	98	—	6 2 6
do. Def.	1½	21½	—	7 1 2
Chile Telephone	8	6⅜	—	5 18 5
Cuba Sub. Ord.	5	8¾	—	6 1 8
do. Pref.	10	15	—	6 13 4
Eastern Extension	7	11½	+ ½	*6 19 1
do. 4 Deb.	4	79	—	5 2 1
Eastern Tel. Ord.	7	115	—	*6 19 6
do. 3½ Pref.	3½	70	—	5 0 0
do. 4 Deb.	4	81	—	4 19 0
Globe Tel. and T. Ord.	6	9½	—	*7 4 4
do. Pref.	6	10	—	6 0 0
Gt. Northern Tel.	22	35	—	6 5 9
Indo-European	10	60	—	6 10 0
Marconi	10	13½	—	5 1 6
New York Tel. 4½	4½	100	+1	4 10 0
Oriental Telephone Ord.	10	9	—	5 0 0
do. Pref.	6	1⅛	—	5 6 8
Tel. Egypt Deb.	4½	80	—	5 0 0
United R. Plate Tel.	8	5 9/16	+ 1/16	*8 4 0
do. Pref.	6	4⅛	—	5 2 7
West India and Pan.	1	1⅛	—	8 17 9
Western Telegraph	7	11½	—	*6 19 0
do. 4 Deb.	4	81	—	4 16 5
Home Rails.				
Central London, Ord. Assented	4	72	—	5 11 1
Metropolitan	1½	28½	—	5 6 5
do. District	Nil	14¼	+ ¼	Nil
Underground Electric Ordinary	Nil	1⅛	—	Nil
do. do. "A"	Nil	5/9	—	Nil
do. do. Income	6	7⅛	— ½	*9 15 0
Foreign Trams, &c.				
Anglo-Arg. Trams, First Pref.	5½	8⅞	—	7 1 11
do. 2nd Pref.	5½	8½	—	7 17 2
do. 4 Deb.	4	71	—	5 12 7
do. 4½ Deb.	4½	72	—	6 5 0
do. 5 Deb.	5	72	—	6 19 0
Brazil Tractions	8½	47⅞	−1	7 7 4
Bombay Electric Pref.	6	10½	—	5 17 1
do. 4½ Deb.	4½	87	—	5 3 0
Mexico Trams	Nil	33	—	Nil
do. 5 per cent. Bonds	—	40	−5	Nil
do. 6 per cent. Bonds	—	85	—	Nil
Mexican Light Common	Nil	25	—	Nil
do. Pref.	Nil	30	—	Nil
do. 1st Bonds	—	40	—	—
Adelaide Sup. 6 per cent. Pref.	6	5 xd	+ ⅛	6 0 0
do. 5 Deb.	5	98	—	5 2 0
Manufacturing Companies.				
Babcock & Wilcox	14	2⅜	—	6 8 5
British Aluminium Ord.	5	1 7/16	—	4 14
do. Pref.	6	18/8	—	6 9
British Insulated Ord.	15	10⅜	—	7 1 2
do. Pref.	6	5⅝	—	5 2 2
British Westinghouse Pref.	7½	32/6	—	9 7 6
do. 4 Deb.	4	68	—	5 14 4
do. 6 p. lien	6	101	—	5 19 0
Callenders	15	11	—	6 16 4
do. 5 Pref.	5	4½	—	5 11 8
do. 4½ Deb.	4½	92	—	4 17 9
Castner-Kellner	15	8½	—	4 12 6
Edison & Swan, £8 pd.	Nil	11/-	—	Nil
do. do. fully paid	Nil	1	—	Nil
do. do. 4 Deb.	4	58	−2	6 18 0
do. do. 5 % Deb.	5	60	—	8 6 8
Electric Construction	6	13/-	—	9 4 8
do. do. Pref.	7	19/-	—	7 7 4
Gen. Elec. Pref.	6	9½	—	6 6 4
Henley	20	14	—	*8 8 8
do. 4½ Pref.	4½	4⅝	—	4 14 9
do. 4½ Deb.	4½	92	—	4 17 9
India-Rubber	5	8⅞	—	5 14 8
Telegraph Con.	20	31	—	7 15 0

* Allowance made for dividends being paid free of income-tax.

Mackay Companies.—Quarterly dividends are announced of 1 per cent. on the preferred shares, and 1¼ per cent. on the common shares.

Davis & Timmins, Ltd.—Interim dividend at the rate of 6 per cent. per annum on ordinary shares for the past half-year.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, September 1st.

CHEMICALS, &c.		Latest Price.	Fortnight's inc. or Dec.
a Acid, Hydrochloric	per cwt.	..	..
a " Nitric	"	..	..
a " Oxalic	per lb.	1/-	..
a " Sulphuric	per cwt.	..	..
a Ammoniac Sal	"	£49	..
a Ammonia, Muriate (large crystal)	per ton	£40	..
a Bleaching powder	"	£9	..
a Bisulphide of Carbon	"	£23	..
a Borax	"	£23	..
a Copper Sulphate	"	£28	..
a Lead, Nitrate	"	..	..
a " White Sugar	"	..	..
a " Peroxide	"	..	..
c Methylated Spirit	per gal.	..	..
a Potassium, Bichromate, in casks	per lb.	8½d.	..
a Potash, Caustic (88/90 %)	per ton	..	..
a " Chlorate	per lb.	1/4½	1½d. dec.
a " Perchlorate	"	1/6	..
a Potassium, Cyanide (98/100 %) (for mining purposes only)	"	Nom.	..
a Shellac	per cwt.	65/-	..
a Sulphate of Magnesia	per ton	..	..
a Sulphur, Sublimed Flowers	"	£11 10	..
a " Recovered	"	£8	..
a " Lump	"	£8 10	..
a Soda, Caustic (white 70/72 %)	"	..	..
a " Chlorate	per lb.	1/3	1d. inc.
a " Crystals	per ton	45/-	..
a Sodium Bichromate, casks	per lb.	5d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots	per ton	..	..
b " Wire, in ton lots (1 to 14 S.W.G.)	"	..	..
b " Sheet, in ton lots	"	..	..
b Babbitt's metal ingots	"	£80 to £221	..
c Brass (rolled metal 2" to 12" basis)	per lb.	1/1⅞ to 1/2¼	..
c " Tubes (solid drawn)	"	1/1 to 1/1¼	..
c " Wire, basis	"	1/1 to 1/1¼	..
c Copper Tubes (solid drawn)	"	1/1½ to 1/1⅔	..
g " Bars (best selected)	per ton	£98	..
g " Sheet	"	£98	..
g " Rod	"	£98	..
d " (Electrolytic) Bars	"	£84 10	£2 10 inc.
d " " Sheets	"	£102 10	£2 10 inc.
d " " Rods	"	£91 10	£2 10 inc.
d " " H.C. Wire	per lb.	11¼d.	¼d. inc.
f Ebonite Rod	"	3/-	..
f " Sheet	"	2/6	..
g German Silver Wire	"	1/10	..
h Gutta-percha, fine	"	6/10	..
h India-rubber, Para fine	"	2/4⅔	..
f Iron Pig (Cleveland warrants)	per ton	65/1⅔	..
f " Wire, galv. No. 8, P.O. qual.	"	£26	..
g Lead, English Pig	"	£23 5	£1 5 inc.
g Mercury	per bot.	£17 5	£1 dec.
e Mica (in original cases) small	per lb.	4d. to 2/6	..
e " " " medium	"	5/- to 5/-	..
e " " " large	"	6/6 to 10/6 & up.	..
o Nickel, sheet, wire, &c.	"	Nom.	..
p Phosphor Bronze, plain castings	"	1/1 to 1/3½	..
p " " rolled bars & rods	"	1/2 to 1/3½	..
p " " rolled strip & sheet	"	1/3½ to 1/6½	..
e Platinum	per oz.	185/-	..
d Silicium Bronze Wire	per lb.	1/3	..
r Steel, Magnet, in bars	per ton	£80	..
g Tin, Block (English)	"	£152 10	10/- inc.
n " Wire, Nos. 1 to 16	per lb.	2/7	..
p White Anti-friction Metals	per ton	£52 to £194	..
k Zinc, Sh't (Vieille Montagne bnd.)	"	Nom.	..

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
j Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p
r W. F. Dennis & Co.

Oxford Electric Co., Ltd.—Interim dividend at the rate of 5 per cent. per annum on the ordinary shares for the past half-year.

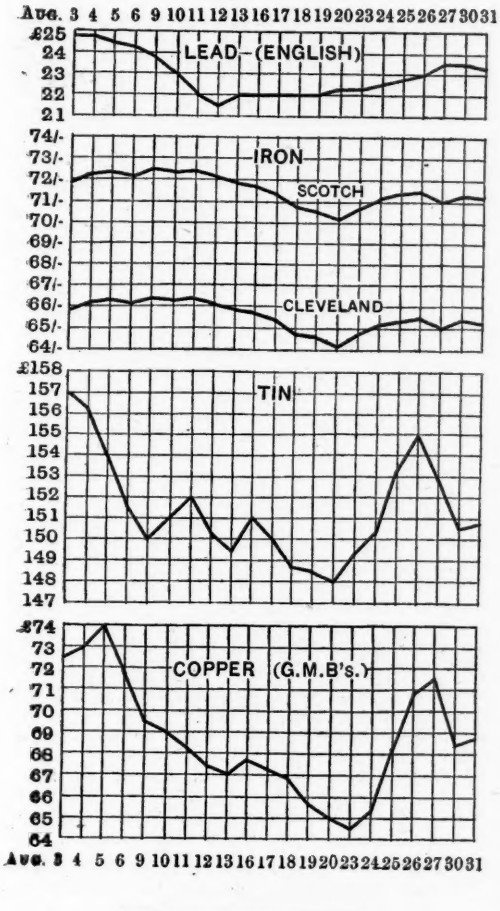
Fairbairn Lawson Combe Barbour, Ltd.—It is announced in the Press that on account of war conditions the directors do not consider it advisable to declare an interim dividend on the preference and ordinary shares for the half-year ended June 30th. Last year there was no interim dividend on the ordinary shares.

Dumbarton Burgh and County Tramway Co., Ltd.—After providing for interest on debenture stock, the profit for the past year, including balance brought forward, was £10,790. After paying a dividend of 1½ per cent. on the ordinary shares, £3,595 is to be carried forward.

South Metropolitan Electric Light and Power Co., Ltd.—The warrants for dividends on the 7 per cent. cumulative first preference shares, and 6 per cent. cumulative second preference shares, were posted on Monday.

METAL MARKET.

Fluctuations in August.



A Wrecked Power Plant.—Our contemporary *Power* describes the collapse of the power plant of the Knickerbocker Portland Cement Co., at Hudson, N.Z., owing to the slipping and subsiding of the earth on which it was built. The plant stood on a terrace of brick clay, 50 ft. thick, and a substratum of shale, which had become a semi-fluid mass at the water level of an adjoining creek. The combined weight of the building and about 50,000 cb. yd. of crushed stone piled in a stock yard, overloaded the ground, and caused it to shift sideways, and settle from 15 to 25 ft. below its original level. The building had concrete foundations, and contained six water-tube boilers supplying steam to two 2,000-KW. Curtis turbine sets. The boilers did not burst, but escaping steam from broken pipes was probably the cause of death of five men and injury to four others. Judging from the illustrations, the power-house was completely wrecked; a 175-ft. reinforced concrete chimney on its base slid, base and all intact, from its original position to the creek, a distance of 75 ft., before falling over. Various other plant on the site subsided; for instance, a 60-ft. elevator sank 30 ft. and swung out of plumb. It is not known how much of the machinery will be found re-serviceable, but the damage is estimated at $300,000.

Federated Malay States.—Our contemporary *Eastern Engineering*, in a recent issue described the workshops of the F.M.S. Railways. The whole of these works are electrically-driven, and in addition 120 coaches are electrically lighted on the Stone system. For the works, situated three miles north of Kuala Lampur, three-phase current at 5,500 volts is obtained from a hydro-electric plant 10 miles away, and transformed down at the works to 400-430 volts, for transmission by overhead wires to the various shops. The works sub-station also contains a 75-90 KW. three-phase belt-driven set, coupled to a Robey undertype engine and used for working overtime. The motors now installed total over 1,019 H.P., in various sizes from 1 to 40 H.P., supplied by the British Westinghouse, British Thomson-Houston, Lancs. Dynamo, Siemens and Oerlikon Companies. A 60-ton traverser is worked by a 20-H.P. motor: there are four overhead cranes of the three-motor type; and all the wheel lathes and larger and more modern tools have individual drive, the smaller machines being group-driven. It may be noted that the company operates two electric lifts, 1,988 30, 60 and 100-watt lamps, 54 arcs and 187 fans distributed over its system. The Port Swettenham power scheme will also be running before long.

ENCOURAGING THE USE OF ELECTRIC MOTOR VEHICLES.

A SCHEME which has long been advocated in connection with the use of electric motor vehicles—that of central station companies supplying interchangeable fully-charged batteries—has lately been inaugurated in Boston, U.S.A., as a result of the joint efforts of the Edison Electric Illuminating Co. of that city, and the General Vehicle Co., of Long Island City, N.Y. The scheme relieves the user of practically all responsibility concerning the charging and care of the batteries, and also enables him to obtain practically continuous service, if necessary, through the interchange of discharged batteries for fully-charged ones. The arrangement, which is equivalent to a leased equipment service has been made possible through the adoption by the General Vehicle Co. of a universal cradle, whereby rapid exchange of batteries can be effected. For that reason, the service is at present only open to purchasers of industrial motor vehicles of this one make.

Under the new system, the purchaser buys his electric vehicle without a battery, thereby saving from 25 to 35 per cent. of the first cost, while the battery and renewals and all charging, are supplied by the Edison Co. on a monthly payment basis. The cost of the service is made up of two parts—a flat rate per month, depending on the carrying capacity of the vehicle, and a running charge based on the mileage indicated by the odometer and determined according to a sliding scale. For a 7 or 10 cwt. vehicle, running 1,100 miles in the course of a month, the total cost for battery and current works out at slightly over £9.

The system has not been in operation a sufficient length of time to enable a close comparison to be made between the cost of operation under the new method, and that under the conventional flat-rate charging system in which the batteries are provided and maintained by the vehicle owner. It is the expectation of the Edison Co., however, that the service will represent an actual economy to the consumer of at least 15 per cent., quite apart from the greater freedom from battery worries that the user will enjoy.

Under the terms of the agreement with electric vehicle owners, the electricity supply company undertakes to equip the customer's vehicle with a lead battery of sufficient size and capacity, ready for use, and to either recharge it or exchange it for a fully-charged battery whenever necessary. Upon application, the company also agrees to furnish the driver at the time of supplying the battery with a coupon stating the number of miles the battery should be able to propel the vehicle under ordinary conditions. If the battery fails to perform this stated mileage, the company will pay the cost of towing the vehicle back to the garage. It is also part of the agreement that the customer shall keep his vehicle thoroughly greased and oiled, and in proper repair; he must also allow inspection to be made by the electricity supply company's officers, and immediately remedy any defective conditions to which his attention is called.

The rates per month for vehicles of different capacities are shown in the appended table:—

	Fixed monthly charge.	Running costs per mile— 1st 500 miles.	500 to 750 miles.	750 to 1,000 miles.	Over 1 000 miles.
7-10 cwt. vehicle ...	£3 10 6	1½d.	1¼d.	1¼d.	1d.
18 „ „ ...	4 7 6	1¾d.	1½d.	1¼ l.	1¼d.
36 „ „ ...	5 16 6	2½d.	2¼d.	2d.	1¾d.
3-3½ ton „ ...	6 17 6	3d.	2¾d.	2½d.	2¼d.
4½-5 „ „ ...	7 10 0	3½d.	3¼d.	3d.	2¾d.

Though the scheme has so far only been adopted in a limited way and put in operation at a single central station in Boston, it is already attracting considerable attention, and is regarded as a departure that is fraught with many possibilities. The Edison Co. states that the extension of the idea to other points in the city only awaits the advent of a sufficient demand. While often discussed in the past, the realisation of such a scheme has long been delayed by the lack of a universal battery system and the difficulty of establishing the necessarily harmonious arrangements between the electric vehicle builders and central station engineers; consequently the new departure will be watched with interest by all associated with the electrical vehicle movement.

PROGRESS IN HIGH-FREQUENCY ALTERNATORS.

[COMMUNICATED.]

THE impossibility of securing from arc or spark a train of radiographic waves of that degree of uniformity desirable in wireless telegraphy, and imperative in radio-telephony, has directed a vast amount of attention towards the discovery of a means of generating very high-frequency currents by dynamo-electric machinery. It is impracticable to attain any suitable frequency by adhering to standard alternator design; pole pitch, air gap and winding space become impracticably small, and insulation and iron-loss difficulties insuperable. No radical progress was made for 20 years after Tesla built his 1-K.V.A., 5-kilocycle machine in 1889. It is true that Alexanderson completed in 1909 a 2-K.V.A., 100-kilocycle alternator, but even this machine, the fruit of five years' labour, gave inadequate power, though it generated current of the right order of frequency. To combine extra-high frequency with reasonable power output, it was necessary to employ new principles. A series dynamo in an oscillating circuit annuls the resistance of the circuit, which thus becomes the seat of undamped oscillations, but the high pressures induced at high frequencies in the short-circuited turns render commutation impracticable. The Dolezalek alternator suffers from no such limitation, and has the great advantage of requiring no rotor winding. As first built for testing purposes, the machine comprised a direct-current electromagnet with pointed pole pieces, before which a toothed iron disk rotated, and thus induced high-frequency currents in coils wound on the magnet poles. Béthenod's 1907 alternator built on this principle is illustrated diagrammatically in fig. 1. High-frequency current generated in the single winding E by rotation of the toothed and laminated disk D, is superimposed on the continuous exciting current, and excites the antenna A through a transformer T; an inductance S and condenser C are used to exclude alternating current from the primary source P. For a given number of teeth and revolutions per minute this alternator provides double the frequency obtainable from any ordinary type of alternator, but at the time of its introduction serious objections were raised against the use of iron at high frequencies.

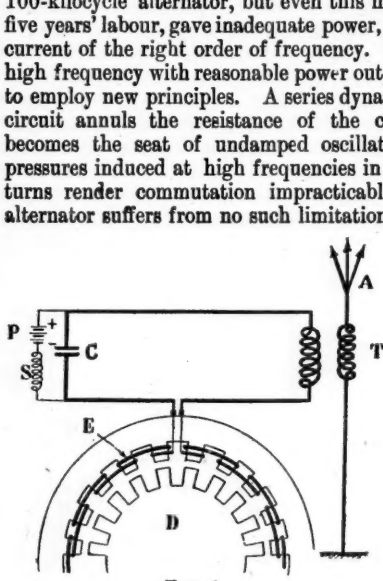


FIG. 1.

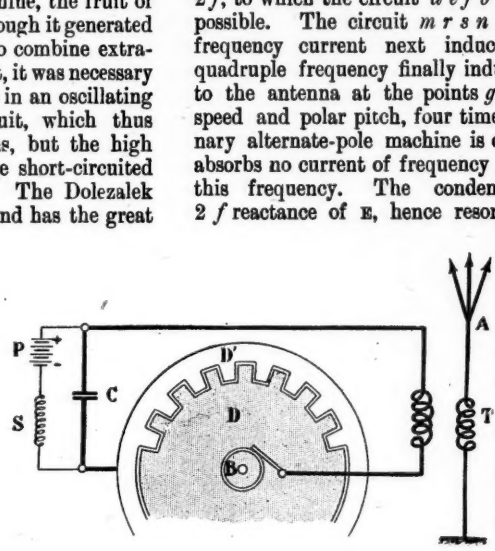


FIG. 2.

The machine illustrated in fig. 2 was devised to meet this objection by using toothed disks D D', constituting a rotary condenser of rapidly varying capacity. Iron losses are eliminated, but the high exciting pressure necessary introduces insulation difficulties, and the air gaps necessary on these grounds preclude the obtaining of considerable output. Resonating particular harmonics of a magnetic field affords one means of obtaining high-frequency currents, but the difficulty is to secure sufficient amplitude in high-frequency harmonics; and to attempt to do so by using special pole shapes introduces constructional difficulties, frequently greater than those involved by adapting standard types of alternator to high-frequency work. The principle which has given best results so far is that of "cascading" machines or windings, so as to superpose on mechanical rotation the rotation of high-frequency magnetic fields. Jarvis Patten proposed in 1894 to use n cascaded single-phase alternators in conjunction with suitable resonating circuits to produce current of n times the frequency of a single machine. Ten years later Latour showed how squirrel-cage machines could be used in this connection, but not until 1907 did Goldschmidt effect a radical improvement by utilising a single machine for several successive frequency conversions.

In order to facilitate comparison with the Béthenod alternator, the characteristics of the Goldschmidt alternator may be enumerated briefly. Referring to fig. 3, the stator and rotor are provided with single-phase windings E E' of as high frequency as possible. Closing the key M sends direct current through the stator winding E, and thus induces current of frequency $f = w/2\pi$ in the rotor. The reactance of the circuit $m\ n\ q\ p\ m$ is adjusted to practically zero for current of frequency f, and the relatively large current thus obtained induces stator current of frequency $2f$, to which the circuit $a\ e\ f\ b$ offers as little reactance as possible. The circuit $m\ r\ s\ n$ is resonated to the triple-frequency current next induced in the rotor, and the quadruple frequency finally induced in the stator is applied to the antenna at the points $g\ d$. With given peripheral speed and polar pitch, four times the frequency of an ordinary alternate-pole machine is obtained. The shunt $g\ f\ d$ absorbs no current of frequency $4f$, since it is not tuned to this frequency. The condenser $g\ e$ compensates the $2f$ reactance of E, hence resonance of the $a\ e\ f\ b$ circuit is not disturbed by exciting the aerial. The principle of augmenting frequency by "reflexion" has no theoretical limit, the stator winding carrying currents of frequencies 0, $2f$, $4f$, $6f$, &c., and the rotor the odd frequencies f, $3f$, $5f$, &c., but in practice it is hardly possible to utilise higher than the quadruple frequency, owing to the complexity of the resonating or "filtering" circuits for higher frequencies. Nevertheless, the latest Goldschmidt alternators are capable of providing 150 KW. at 40 kilocycles, there being 384 wound poles and the speed (3,100 R.P.M.) being low enough for direct driving from a continuous-current motor.

In the Béthenod alternator represented diagrammatically in fig. 4, four machines are used in a common carcass. Continuous current is fed to the stator A_1 to induce two-phase current of frequency f in the rotor B_1, which is connected to that of the rotor and produces current of frequency $2f$ in B_2. Proceeding thus, there is available from B_4 two-phase current of quadruple frequency. The axial space between the cascaded alternators need actually be no greater than ventilation ducts, and the rotors B_1 A_2, B_3 A_4 can be provided with common windings of the squirrel-cage type, so that the constructional complexities are no greater than in the Goldschmidt machine. The fact that two-phase current is used involves at least two coils per pole

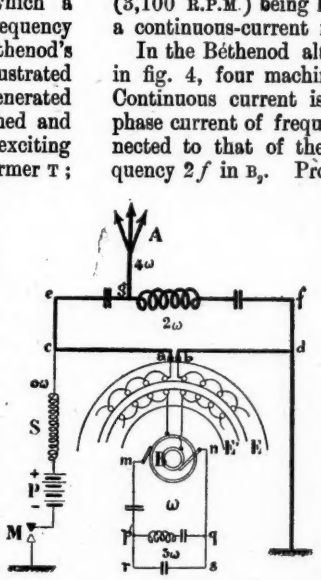


FIG. 3.

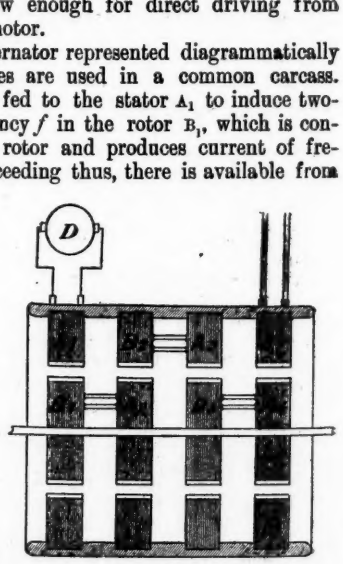


FIG. 4.

pitch, but this is a less serious objection than might appear to be the case, because an industrial machine must have a certain minimum air-gap, and hence a pole pitch which permits two slots without increase of pole pitch on this ground alone.

The method by which both phases of the current are utilised in the aerial is indicated in fig. 5, where E_1, E_2 represent the two phases of B_4, fig. 4. One winding E_2 is connected directly between aerial and earth, through a tuning inductance and capacity, L_2 C_2. The other phase excites the aerial through a transformer T. If C_1 C_2 be adjusted to compensate self-induction in their respective circuits, if R represent the apparent (radiation) resistance of the aerial, and M the coefficient of mutual induction of T, the condition that the currents in E_1, E_2 be of equal amplitude and displaced $\pi/2$ in phase, is :—$M = R/4\pi . mf$, where (mf) = frequency of the last alternator in the cascade. The E.M.F. and current in each phase being in phase, the equipment works under very favourable conditions. From a machine running at 6,000 R.P.M., with a rotor 15 in. in diameter and 240 slots in rotor and stator, M. Béthenod obtains 5 KW. output at 24 kilocycles, and states that machines of 100-150 KW. output at this frequency are under design.

The advantages of polyphase generation in respect of freedom from parasitic fields are combined with the constructional advantages of a single-phase winding on the

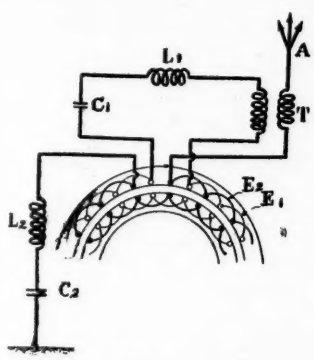


Fig. 5.

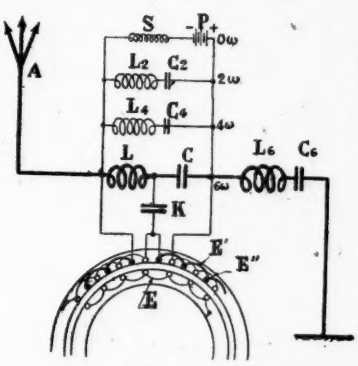


Fig. 6.

rotor, in Latour's two-phase induction machine with single-phase rotor short-circuited on itself. If f be the rotor frequency produced by continuous-current excitation of the stator, the Latour machine converts two-phase current of frequency kf to $(k + 2)f$ frequency, and may be connected to the aerial as shown in fig. 6. The continuous-current source P produces current frequency f in the rotor E, and this, by the action already described, produces currents of double and quadruple frequency in the resonant circuits L_2 C_2, L_4 C_4. Limiting ourselves to the production of sextuple frequency, the aerial is connected to the resonant circuit L_6 C_6, a condenser L and C being so connected that the phases E′, E″ yield wattless leading and lagging currents of equal intensity and set up a field rotating oppositively to the rotor, and cancel the parasitic field due to circulation of the sextuple frequency working current in the stator windings. Unless this compensation be arranged, the stator windings become equivalent to a simple single-phase winding.

The conclusions reached by M. Béthenod, in discussing these developments in an address to the Société Internationale des Electriciens last summer, were that industrial alternators of acceptable efficiency could now be built for outputs of 100 to 150 KW. at 10 to 40 kcy., running at a peripheral rotor velocity of from 24,000 to 30,000 ft. per minute, but that, since the difficulty and cost of construction increase rapidly with frequency even in the above range, the industrial success of high-frequency alternators, as applied to wireless telegraphy and telephony, depends on the adoption of long wave-lengths—probably several tens of kilometres. So far as one can see, the accuracy of this conclusion must be admitted, but the writer well remembers how, a few years ago, one who ranks undoubtedly among the greatest experts on radio-telegraphy, "proved" on paper that alternators exceeding a few watts capacity, could not be built on the Goldschmidt principle. Moreover, the proof was, at that time, convincing, and its subsequent refutation was only another demonstration of the need for caution in placing any limitations on the development of radio-telegraphy in general and high-frequency alternators in particular.

THIRD-RAIL CONSTRUCTION ON THE L. & Y. MANCHESTER–BURY LINE.

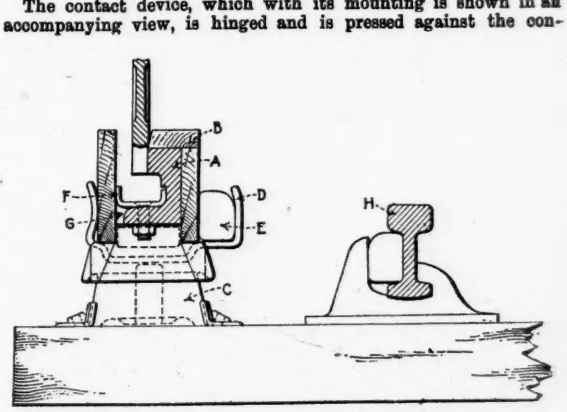
Our contemporary, the *Electric Railway Journal* (New York) referring recently to the placing in commission of the Lancashire and Yorkshire Electric line between Manchester and Bury, described a novel form of 1,200-volt third-rail contact system which is the invention of the general manager of the company, Mr. J. A. F. Aspinall. The distance between Manchester and Bury is 9½ miles.

The essential features of the invention are clearly shown in the accompanying illustrations, the most novel ones having to do with the side bearing of the contact device upon the rail and the method of surrounding the rail with wood guards.

Referring to the cross-sectional view, which shows the preferred form of contact rail, it will be noted that a channel form of rail is used with a head sufficiently thick to provide a wide contact surface on the side. The form of rail was selected to provide a low centre of gravity to prevent overturning even when the rail is not fastened down. While any form of rail can be used, this is one also well adapted to enclosing with protecting wood guards. The contact rail is set upon insulators provided with lugs to prevent lateral movement. It is almost entirely enclosed with boards of Australian karri timber which cannot be set on fire. The only openings around the rail are a slot at one side of the cover for the accommodation of the current collector, and drainage holes, as G, are provided to prevent accumulation of water in the groove formed between the guard and the collector rail. There is not a nail or bolt anywhere in the protecting guards.

The angle-shaped guard, B in the illustration, rests directly against the rail surface, but the invention covers insulation therefrom if such is found necessary. The guard on the slot side is spaced away from the rail by means of a wooden filler block, termed by Mr. Aspinall a packing or distance piece. Over the rail base is a bent metal distance piece F secured in place as shown. The guards are attached to the collector rails without bolts by means of detachable metal clamps D placed between insulators. In connection with these are used wooden keys E, preferably similar to those used in fastening the running rails in their chairs. In the diagram one of the running rails is shown at H, with the wedge holding it in its chair. The relation of the running and conductor rails, in regard to heights and spacing, are incidentally brought out in this figure.

The contact device, which with its mounting is shown in an accompanying view, is hinged and is pressed against the con-



Sectional View, L. & Y. Protected Contact Rail.

tact rail by means of a coiled spring. The method of mounting upon an insulating support is clearly shown.

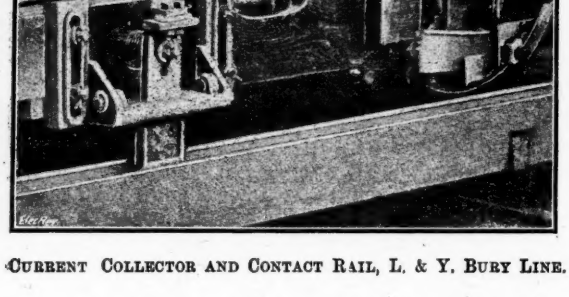
The advantages of this novel construction over the usual one appear to be that very complete protection can be furnished and provision can easily be made for considerable vertical variations in the relative positions of rail and collector. The simplicity of the construction is such that the ordinary trackman or platelayer can keep the contact rail in order, with the exception of the bonding.

The Manchester papers, in referring to the state of progress of this line, mention that the third rail construction is completed except

as regards a short section near the Manchester end, and that the rolling stock is also ready, the cars being somewhat similar to those employed on the Liverpool-Southport section, being of the

Current Collector and Contact Rail, L. & Y. Bury Line.

corridor type with seats for about 100 persons. Trains will consist of three to five cars. The Clifton Junction power station is to be in working order by the end of the year, but in the meantime arrangements have been made to obtain a supply of electricity



Manchester-Bury Electric Line, showing Entering Ramp of Contact Rail.

from the Manchester Electric Supply Department, which has fulfilled a similar function in connection with experimental running. We gather that it is hoped to commence a service of some sort on the new line in October or November, which will connect at Bury with a short electrical branch line to Holcombe.

TURBINE PUMPS FOR COLLIERY PUMPING.

(*Abstract of paper read before a joint meeting of the* National Association of Colliery Managers and Association of Mining Electrical Engineers by R. H. Willis.)

Although turbine pumps are now being freely used in colliery work, there may be some to whom they are still something of a novelty. Many pumps of this type are at work, but it is not the best to use under all circumstances; for example, in the case of pumping near the face, when the supply of water is more or less intermittent and yet cannot be allowed to collect, a turbine pump is not suitable, as it cannot pump air and water, and would require constant priming; a ram pump is more suitable. Or again, if a small amount of water is to be lifted against a high head, then a turbine pump, while capable of doing the work, compares unfavourably with a ram pump. In such a case the number of chambers becomes excessive at reasonable speeds and the efficiency is low. As a rule, seven or eight stages are the maximum number which can be economically used.

The chief improvements which have enabled the modern turbine pump to deal with high heads have been the multiplication of impellers, the addition of diffusion vanes, and improved methods of manufacture. The most important improvement has been the diffusion vane, which receives the water after it leaves the impeller at a high velocity, and by guiding it through suitable passages causes the velocity to be comparatively reduced, the kinetic energy due to the velocity being thus converted into static energy.

With the turbine pump there is no actual displacement of water as in a ram pump, as the action depends on the velocity imparted to the water, due to the revolving impeller, which velocity is ultimately changed into pressure head. Owing to this feature there is no necessity to provide relief valves, as the pressure never rises materially above that due to the velocity set up by the speed of the impellers. Consequently, this type of pump can be started up with the delivery valve closed. This fact is a great advantage, as the power then taken is a minimum, and there is no chance of accidents happening as would be the case if this procedure were adopted with a pump of the ram type. As the water always passes through turbine pumps in one direction, and as it is acted upon equally by the impellers at all parts, the water leaves the pump in a constant stream, and there is no need to provide air vessels. This is an important advantage, as it prevents shocks to the pipe system and gives a steady uniform flow of water, allowing the use of the minimum size of delivery pipes.

One of the main difficulties which has had to be overcome in evolving this type of pump is that of end thrust. Two main methods have been evolved to overcome this difficulty, and these are practically the only methods now in use. The first and somewhat older method aims at balancing the whole out-of-balance thrust at one point, and the second aims at neutralising the end thrust where it is generated, viz., at each individual impeller. In the first system a metal disk of saucer shape is attached to the end of the shaft and rotates in an annular space, this disk being known as a balance plate or disk; on its edge is a turned face which corresponds with a turned surface or seat on the end chamber casting. The annular space surrounding this disk is connected to the suction side of the pump. Leakage water under pressure from the last impeller chamber passes to the interior of the disk, causing the same to lift off its seat, when the pressure water immediately escapes to the suction. If the supply of leakage water ceased, then the disk would be drawn back on to its seat by the end thrust. As leakage is constantly going on, the disk takes up a more or less permanent position, allowing as much water to escape as will keep the disk in equilibrium and balance the end thrust. This system works well, but the disk is liable to excessive wear if there is any grit in the water, and the amount of water passed may become excessive; or the amount of leakage water due to wear may so increase that a state of equilibrium can no longer be maintained, and the pump will soon require a new disk and probably a thorough overhaul.

The second system is somewhat simpler; in this case there is no large balance disk, but each impeller is provided with two neck rings, and the spaces on either side of each impeller are put into communication with each other by means of special passages in the main castings which pass round the diffusion vanes. The pressures on the two sides of each impeller are thus in equilibrium, and any out-of-balance thrust is counteracted and corrected. This system, having no mechanical parts, is not subject to wear. Turbine pumps are essentially high-speed machines, and consequently lend themselves readily to coupling to electric motors. For D.C. motors it is advisable not to exceed 1,800 R.P.M. for the smaller and about 1,000 R.P.M. for the larger sizes. Recently, however, specially designed D.C. motors having commutating poles and compensating windings in the main pole faces have been successfully used for high speeds and powers.

The writer recently installed a motor of 250 H.P., 440 volts, running at 1,500 R.P.M., direct-coupled to a turbine pump, which has given very good results. For A.C. motors, 1,500 R.P.M. synchronous speed is about the maximum, although some motors have been installed running at 3,000 R.P.M. This speed, however, with 50 cycles, involves a two-pole motor, which is a somewhat difficult machine to build.

While referring to the question of pumps' speeds, attention should be drawn to the effect which variations of voltage have on the behaviour of a turbine pump when coupled to a D.C. motor. If the voltage rises, the motor speed rises, with the result that the pump endeavours to accelerate the column of water and to increase its quantity, and thus an overload is thrown on the motor. If, however, the voltage drops, then the speed drops and the pump ceases to deliver water, and if then the voltage should suddenly rise, a heavy overload is thrown on the motor by the pump endeavouring to suddenly accelerate the water column, which may result in a flash-over on the motor or the blowing of the fuses. This difficulty can be met by arranging that the minimum speed at which the pump will deliver water is below the minimum due to the greatest voltage drop. It is important, therefore, that the supply voltage be kept as constant as possible and the motor be so designed that it has a minimum speed variation for any given voltage variation. Another point is the possibility of the motor being overloaded if the pump is working against a lower head than that for which it was designed. This is due to the fact that the surplus power expends its energy in increasing the velocity of the flow of the water (consequently the quantity) in all parts of the piping and pump. The friction head is thereby increased and the efficiency decreased, and this artificial and inefficient load may exceed the normal power of the motor. When inquiring for a turbine pump the fact should be borne in mind that there is no actual displacement of water, and that the impellers have to be designed to suit a certain head. If this head is greater than that for which the pump was designed, there will be no delivery of water. If this head is less than that for which the pump was designed, then the quantity of water delivered will be more than the designed amount, and the motor will be overloaded. It is a general practice to make the motor some 10 per cent. larger than is required for the normal duty in order to provide a margin of power to meet the above conditions. Turbine pumps can be provided with

special impellers so designed that the variation of horse-power due to the variations in head is only a very small percentage. This is not altogether an advantage, as it often results in reduced efficiency. There are some special classes of colliery pumping for which the use of turbine pumps may not as yet have become general, such as dip pumping, and sinking, although both classes of work have been successfully performed by this type of pump.

The turbine pump lends itself very readily to the unwatering of vertical shafts; it is compact, takes up little room, and weighs less than a ram pump or steam pump. For this purpose the motor and pump are arranged with vertical spindles and carried in a frame so arranged that the whole combination can be lowered down the shaft to follow the water as the level is reduced. In this case it is usual to prevent overloading of the motor by screwing down the valve on the delivery side so as to add an artificial head to the actual head on the pump, giving a total head approximately equal to the designed head, the valve being gradually opened as the pump is lowered in the shaft. Dip pumping is very often required in colliery practice, and some engineers are of the opinion that this problem is one which is unsuitable for turbine pumps, but the difficulties can be overcome as follows:—The pump is mounted on a trolley which is so designed as to keep the pump horizontal. The pump is so arranged that a varying number of impellers can be brought into operation from time to time, the chambers not required being replaced by dummy stages, which are removed as required. The pump starts to work against a minimum head, and with only one impeller, say, in a four-stage pump, in operation, all the remaining chambers in the pump being dummies with, of course, a clear waterway through them. The motor is some 10 per cent. larger than is actually required, and is of the variable-speed D.C. type. As the pump is lowered shunt resistance is inserted in the motor field, and the motor speeded up until a point is reached when the head dealt with is equal to that of two impellers when running at the lowest speed of the motor. Two impellers are then put in the pump and the motor worked at its lowest speed. The same cycle of operations is followed until ultimately the pump has its full number of impellers. By this method the maximum of water is obtained with the minimum amount of current throughout the whole period, and the total result compares favourably with the performance of a ram pump which has generally been used for this purpose. Practically the same arrangement can be followed when the pump is driven by a three-phase motor, but owing to the motor speed being constant, the working is not quite so flexible as with a direct-current motor, and resort has to be made to throttling by means of the valve on the delivery side after changing the number of impellers, so as to prevent the motor overloading itself at this point of the operation.

For boiler feeding purposes turbine pumps are very suitable. Their freedom from all risk of serious pressure rises should all the openings into the boilers be closed while the pump is running at full speed, and the constant flow of water, are very desirable features.

The efficiency of this type of pump varies somewhat with the output from, say, 67 per cent. to 71 per cent., the most efficient result being obtained when the gallons delivered per minute are about 25 per cent. more than an amount equal to the head in feet. When interest on capital, depreciation and maintenance charges are taken into account, it will be found that the cost of running is about the same, notwithstanding the higher efficiency of ram pumps. If the pumping is done in a few hours, then the advantage lies with the turbine pump; if the pumping must go on more or less continuously, then a ram pump is more favourable.

When considering the purchase of turbine pumping plant the following points should be carefully considered:—(*a*) The pump should be capable of being easily dismantled and erected. In this connection the author does not advocate the type of pump in which the chambers are placed inside a cast-iron containing shell; (*b*) all wearing parts should have ample area and be capable of renewal on site; (*c*) all similar pumps should be made interchangeable, and effective methods should be adopted to obviate the end thrust.

When installing a turbine pump the following points should be borne in mind:—(*a*) The pump should be fixed as close to the water to be lifted as possible, and the suction pipe must be made airtight, leakage of air being a fruitful source of trouble with this type of pump; (*b*) the suction pipe should be provided with foot valve and strainer, and if the water contains grit or dirt, a dividing wall in the suction pond to allow the dirt to settle before reaching the suction pipe is an advantage; (*c*) a vacuum gauge is an important accessory on the suction side as it indicates if there is any leakage of air; (*d*) on the delivery side all sharp bends in the pipe line should be avoided; (*e*) a sluice valve and non-return valve should be fixed between the pump and delivery pipe, both provided with a by-pass valve so that the pump may be primed from the water in the rising main. A pressure gauge is also a useful addition.

When starting the pump it is important to see that the sluice valve is closed and then to open the air cocks on the pump and open the small by-pass valves until the water runs out of the air cocks; the air cocks are then closed, and also the by-pass valves, and the motor started. When up to speed, the sluice valve is opened until the needle on the ammeter shows full-load on the motor. To shut down, the sluice valve is closed and the motor switched off. The whole operation is very simple and the risk of damage is reduced to a minimum. It is advisable to make a gauge of the length between, say, a mark on the shaft and a fixed point, such as the nose of the bearing, and to check this length from time to time, so as to be able to note any tendency towards end movement. If such movement is observed, then the makers should be advised.

OIL CIRCUIT BREAKERS: NOTES ON ARC PHENOMENA AND TENDENCIES IN DESIGN.

In a paper read recently by Mr. K. C. Randall before the American Institute of Electrical Engineers, the author dealt with the above subject; the following is an abstract of his remarks:—

In an alternating-current arc formed in an oil breaker, opportunity is afforded for cooling and condensing the arc gases as the current passes through zero, and if these are completely condensed or removed and replaced by sufficient oil distance, the current will not be re-established, because the medium intervening between the separating contacts has been changed to an insulator of sufficient dielectric strength to withstand the potential tending to re-establish the current. With an ideal oil breaker the current will not continue after the first zero value following the first complete separation of contacts.

In actual practice, on large powers, possibly few breakers comply with this ideal, because the current continues beyond

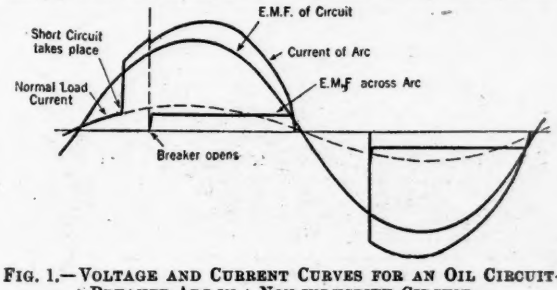


Fig. 1.—Voltage and Current Curves for an Oil Circuit-Breaker Arc in a Non-Inductive Circuit.

the first zero value, due to (1) insufficient separation of the contacts; (2) large amount of gas formed in the arc; (3) reduction of insulating value of oil between contacts owing to suspended metal and carbon particles condensed after each successive half-cycle arc. If the particular breaker application is too far from the ideal the re-establishment of current after the first and subsequent zero values will continue indefinitely, or at least be repeated so many times that the breaker will be damaged or destroyed. Increase in capacity of a system, failure to maintain breakers either as to mechanism or insulation, change of current limitations, changes in methods of

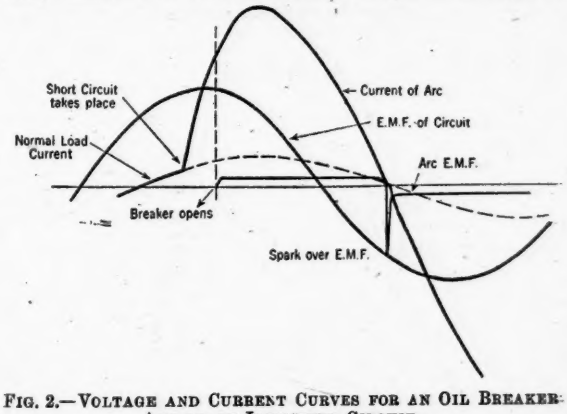


Fig. 2.—Voltage and Current Curves for an Oil Breaker Arc in an Inductive Circuit.

operation, faulty relays, etc., all may act to increase the duty on a breaker, even to destruction.

Plainly, it will be very difficult to interrupt an alternating current abruptly during any half cycle, for the same reason that an abrupt rupturing of a field current of a generator is difficult or dangerous. So it is that the endeavour of the breaker is focused upon providing against the re-establishment of current after normal zero value. Clearly, each time the current is re-established and continues to the next zero value, energy is dissipated in the breaker tank, due to the arc. The oftener this is repeated the more the contacts are burned, the more the oil deteriorates, and the less the chance is of finally interrupting the current.

Assume a breaker, operating on a 15-cycle circuit of a given current and voltage, begins separation of contacts just as the

current is normally passing through zero, and that the separation of contacts (acceleration) is such that the current ceases at the next zero. This same breaker operated in the same way on a like 60-cycle circuit will dissipate the same energy, if the current is of like volume and continues for the same time; that is, ceases at the fourth zero point. But, had the breaker been accelerated to prevent re-establishment of the current after the first half (60 cycles), the minimum energy could have been dissipated. Similarly, on 30 cycles, the speed of opening should have been twice that for 15 cycles; and in general, the rate of contact separation should be proportional to the frequency of the system when endeavouring to attain the ideal condition of terminating current at the end of the first half cycle.

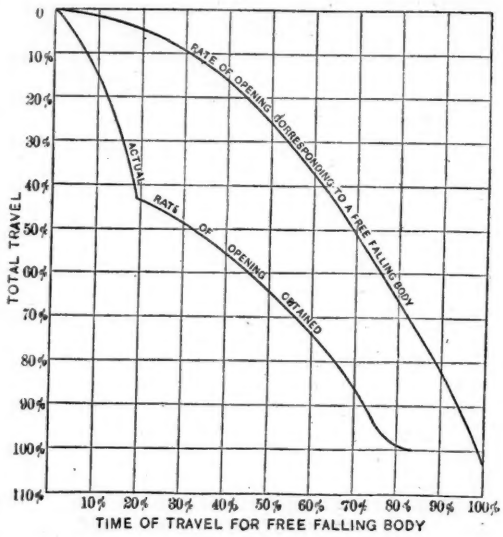


Fig. 3.—Curves of a Free Falling Body and specially Accelerated Breaker built for E.H.T. Service.

The extinguishment of the arc will be near the normal zero point regardless of the speed of opening, because, whatever the rate of separating the contacts may be, tending to rapidly insert a dielectric in the form of cold oil, a potential tending to maintain the circuit current will be developed, and this, in general, will be adequate to break down the intervening dielectric. Thus the current will be sustained until practically its normal zero point is reached. This will be true even if the whole breaker travel were accomplished in, say, $\frac{1}{4}$ or $\frac{1}{3}$ cycle; the current would still continue to practically the normal zero point, as each higher rate of current reduction gives a correspondingly higher sustaining voltage for maintaining it.

Furthermore, neglecting the voltage peaks required for re-establishing the current, the maximum steady voltage attainable across an arc is limited, regardless of the length of arc or current volume, and hence, the same loss is developed regardless of the rate or length of opening, provided the current and time of arcing is the same. This is explained as follows: With practically any current encountered in serious breaker problems, the ionisation in the arc space will be quite complete and, therefore, it will constitute an excellent conductor, becoming better as it is further heated by increased currents, so that the drop will remain practically constant independent of the current volume provided it does not fall sufficiently to threaten deionisation. The distance between contacts when the arc space is completely ionised has very little effect on the drop across it, provided the currents remain large as in ordinary breaker practice. This, therefore, demands for the best breaker results, that the speed and length of opening be such that current may never be established after the first zero value of current following the separation of the breaker contacts.

In general, high-frequency currents will be interrupted with the smaller demonstration and lesser breaker duty than similar lower frequency currents, and the energy dissipated will be, on the average, for an ideal breaker, about inversely proportional to the frequency.

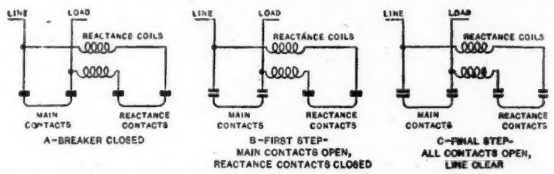
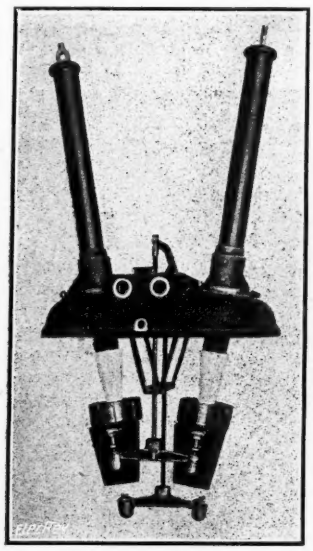


Fig. 5.—Terminal and Contact Arrangement with Reactance Coils of H.T. Reactance Breaker.

After fixing the proper design of conducting details, allowing liberally for the continuous current-carrying capacity and for insulating distances—dielectric strength, such that liberal tests are successfully withstood—the problem of rupturing capacity still remains. On the higher potentials the insulation problems largely govern the dimensions. On the lower potentials mechanical considerations may largely dominate.

Oil, being the accepted insulating medium, should, particularly on higher potentials, be of high grade. At the lower potentials the dielectric value of the oil is not so important. Oils of low volatilisation, slow carbonisation and fair insulating value are desirable for average applications. For very low temperatures non-freezing oil should be used, but these are usually so volatile at ordinary summer temperature that another oil must be used. A large oil volume is considered favourably, as through it the shock from the largely explosive action of enormous arc currents is reduced and absorbed. A large head of oil over the contacts means a heavier pressure on the arc bubble with consequent increased tendency to confine and quickly replace it with fresh oil. Facility of ionisation of arc gases is decreased by higher vapour pressure, thus making re-establishment of the arc more difficult. The reduced volume of the gas bubble, due to the increased oil head, also disturbs the main oil body less, a very important matter when near the limit of rupturing capacity, especially of single-tank units.



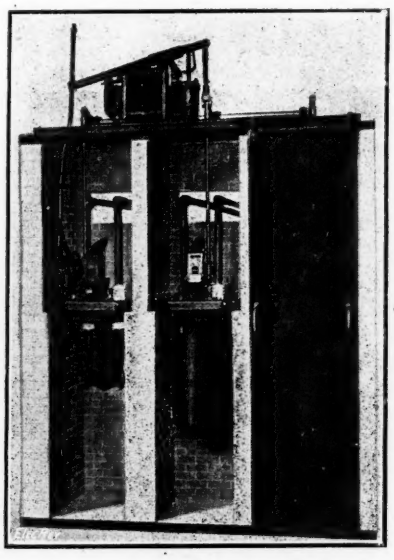


Fig. 4.—100,000-volt Reactance Breaker; Main Contacts separated and Reactance in Circuit; Final Break about to occur.
Fig. 6.—Breaker adapted to Pressures up to 35,000 Volts; Accelerating and Retarding Device shown in Figs. 7 and 8.

The length of break is all-important, but if consideration of arc gases could be entirely eliminated, the length of break should only be sufficient to interpose an oil distance which would not be punctured by the available potential. As a rule, this would require but from 1 to 10 per cent. of the actual travel available, as it takes 50,000 volts to puncture ½ in. of moderately good oil. Therefore, the travel represents a very large margin, but it is necessary due to the reduced dielectric strength—in fact, conducting condition—prevailing during the arcing period. In a number of tests on a 25-cycle power circuit at 12,000 volts, about 15,000 amperes were interrupted at the end of a 4-in. travel (one-half cycle), although the contacts finally separated 9 in.

An increased number of breaks in series, entirely neglecting method of accomplishment, would seem desirable, as the simultaneous opening of several breaks will accomplish the intervention of a given oil distance more rapidly than will a fewer number of breaks, assuming that the rate of contact separation remains roughly the same for both. A scheme to increase the arc voltage would not be welcome, but a plan to reduce it, and yet retain conditions opposed to current recovery after the first normal zero value is desirable, as in this way the total energy dissipated would be reduced. Whether a multi-break design is to be preferred over the usual break will be decided by what may be accomplished

by the common two break construction, when highly accelerated. It is plain that the additional mechanical complications and consequent larger masses of the multi-gap breaker that must be moved, will constitute a very serious problem.

Consideration of fig. 2 makes apparent the general effect of self-induction on current interruption. On a non-inductive circuit (the current and voltage in phase) the chance of current re-establishment is much less probable than with an inductive circuit wherein—with lagging current—voltage is available for re-establishing the arc as the current emerges from the zero value. For this reason interruption of the current at the higher frequencies will be more difficult as the current lag for any given circuit is greater and the voltage tending to re-establish progressively more as the frequency is increased. On the other hand, the total self-induction of high-frequency circuits will usually be less than on circuits of lower frequencies, and, therefore, the termination of the arc current will be facilitated.

In the breaker arc, as chilling occurs near the zero value of current, the ionisation of the gases ceases and conductivity in the arc space is so reduced that the current can only be established by a potential capable of puncturing the resulting

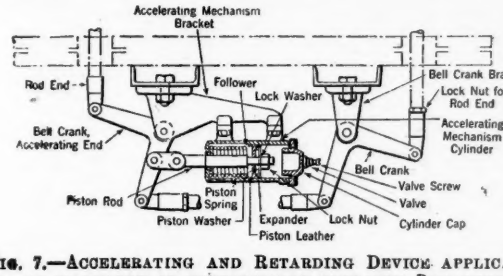


Fig. 7.—Accelerating and Retarding Device applicable to manually or electrically operated Breakers.

dielectric which has become very much stronger than it was previous to deionisation. Very high arc currents, giving increased gas volume, make deionisation much more difficult, thus rendering successive re-establishment of current easier. The enormous energy dissipated by very large currents as the contacts first separate is a demonstration of an explosive character. Breaker tanks have been blown off with practically no contact burning, showing violent pressure of short duration; so large currents are most difficult to interrupt. Facility of deionisation of the arc gases will depend upon temperature and pressure of the surrounding oil, shape and volume of contacts, and on their heat conductivity and vaporising temperature. A small breaker, on the score of volume and shape of contacts alone, is more severely tried than a larger unit. This plainly emphasises the desirability of large contacts of smooth shape.

Gravity-actuated breakers never open quite as rapidly as a free falling body, and sometimes the retarding influence of the mechanism is very serious, so that accelerating devices are now common, and the rate of opening is in many breakers much more rapid than that obtainable from unimpeded gravity alone. The matter of stopping the moving parts as they approach the end of the stroke has to be carefully considered, in the case of larger breakers, even when unaccelerated, but when highly accelerated the problem is more serious and may even be complicated. Fast closing is important like fast opening. An explosive action is likely as the arcing tips of a slow-closing breaker touch when closing against a short circuit, due to the violent energy dissipation and consequent volatilisation of contacts and oil. This action is identical with that occurring in a slow-opening unit. Modern practice, particularly on the score of general simplicity, favours the solenoid operation for all remote-controlled oil breakers, save when manually operated.

Tending to limit the maximum capacity that may be ruptured by a single plain breaker, large current volumes are the most serious problem because of their practically explosive action. Probably the maximum power that plain breakers as now built, could rupture, will approximate the power that would be delivered through a shunt-tripped breaker at the time of opening, by 150,000 K.V.A. of modern high-reactance generators on a single bus, feeding a maximum short circuit, so that the current is limited only by the generator impedance. In general, it will be easier to handle the given short circuit at, say, 15,000 volts, because at higher potentials the chance of re-establishment may be greater, while at lower potentials the volume of current would seriously increase the total amount of energy to be dissipated in the arc, and therefore the difficulty of terminating the current. A breaker adapted to such a station for 15,000-volt service is illustrated in fig. 6, and is constructed with particular regard to obtaining the strong tank and supporting details, so that even with violent energy dissipation in the arc, the mechanical details will withstand the shock. This breaker will require for installation a space approximately 7 ft. 4 in. by 2 ft. 1 in. by 9 ft. high.

In endeavouring to raise the limit of power to which plain breakers may be applied, without employing permanent current-limiting reactance, originally the resistance and later the reactance breakers were developed. Because of difficulties in the design and application of resistance, reactance was substituted, and a considerable number of such breakers has been built. The reactance breaker followed the form of the later resistance breakers, in that two steps were employed; one to introduce the current-limiting reactance, and the second to open the circuit. A still later development of the reactance breaker idea has somewhat simplified the matter. Instead of employing interlocked mechanism, such that the first mechanism introduces the reactors, and the second opens the circuit, two similar breaks are now employed operating simultaneously from a common mechanism—one of which is shunted by a reactance coil. It is well known that the shunted arc is inclined to be unstable, and in actual test it has been found that the shunted breaker does its duty promptly and with very little effort. The final break, of course, will only involve the current permitted by the limiting reactance.

For some time breakers were supplied according to the judgment of the designer of the equipment, or according to the ideas of the purchaser. Now, installations are quite generally receiving individual consideration in the breaker applications, and the desirability of a uniform method of rating is growing constantly more pressing. A method, developed from experience, tests, and consideration of common problems, assumes the breaker to be installed directly on the bus and to protect same against near-by short circuits. In determining the maximum breaker duty a generator equipment of 8 per cent. impedance—capable of delivering 12½ times normal current at the first instant of short circuit, is assumed. It is also assumed that by the time breaker opening occurs, this maximum current value will have decreased to one-half the initial, namely, to 6¼ times normal. In this way, when a breaker design has been fixed as capable of rupturing a certain current at a certain voltage, the K.V.A. rating of the system to which it may properly be applied is one whose normal current rating is obtained by dividing the breaker current rating for the particular voltage by 6¼. Thus a breaker rated at 160,000 K.V.A., three-phase, 44,000 volts, contemplates 2,100 amps. per phase in the arc, and may properly be applied to a station having a normal current of 335 amps. 44,000 volts, three-phase.

All this contemplates instantaneous tripping. If time tripping is employed, application may be made to a still larger station, provided the maximum current mentioned is

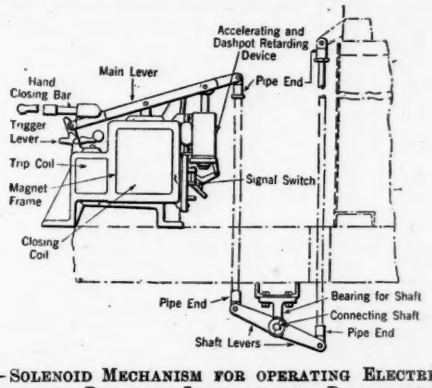


Fig. 8.—Solenoid Mechanism for operating Electrically Controlled Breaker; Incorporating Device shown in Fig. 7.

not exceeded. The time to reach the sustained short-circuit currents will vary widely; possibly from 15 to 50 cycles on 60-cycle systems, and from 5 to 20 cycles on 25-cycle systems. With time elements set for these periods or longer, the maximum duty on the breaker will approximate interrupting double current, and in general, for such installation the capacity of the plant may be at least doubled as against the safe application on instantaneous tripping.

The best method of specifying breaker equipment for a given service is to indicate the duty which the breaker will be expected to perform by giving the maximum current that it may be called upon to interrupt, as well as service voltage.

The present tendency in circuit breakers is largely to improve mechanical details. Insulation of designs has generally been adequate. Among the notable mechanical features found in modern breakers are: (1) Increased strength of tanks with supports and fittings so as to safely withstand the shock of rupturing large powers. (2) Rapid acceleration of breaker so as to obtain high rates of contact separation with the attendant early termination of arcs, and consequent reduced energy dissipation. (3) Provision for vented expulsion chamber over the oil from which gases may escape, without entraining much oil, thus reducing the high and otherwise destructive pressures occurring in heavy duty. (4) Arrangement for liberal and easily replacable contact parts of minimum cost, in even small as well as larger capacities. (5) Employment of larger capacity (single) pole units, suitably assembled, and operated from a single separate mechanism, instead of using multipolar units assembled with individual mechanisms.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

URUGUAY.—The Government have been authorised to prohibit the exportation from Uruguay of the following articles: Unworked metals and worked metals in the form of waste articles or scrap of iron and steel, copper, tin, lead, zinc, aluminium, antimony and combinations of same, such as tinplate, galvanised iron, bronze, solder, brass and yellow metal; wire; surgical instruments or physical instruments for medical use; hospital apparatus and materials. The Executive may, however, in special cases permit the exportations of articles of the kinds specified.

VENEZUELA.—The Government have passed a new stamp tax law, as follows: On documents covering transactions of an estimated or determined value of from 25 to 50 bolivars, a stamp of 5 cents; between 50 and 100 bolivars, 10 cents; between 100 and 200 bolivars, 20 cents; between 200 and 300 bolivars, 30 cents; between 300 and 400 bolivars, 40 cents; between 400 and 500 bolivars, 50 cents; between 500 and 1,000 bolivars, 1 bolivar; over 1,000 bolivars, an additional bolivar for each 1,000 bolivars or part thereof. Civil or mercantile documents of whatever value will be covered by a stamp of 10 bolivars. Sales by credit will pay a stamp tax double that of the above-mentioned tariff, according to the value of the sale. As regards Customs documents, manifests of importation or exportation will carry a stamp of 2 bolivars for each 1,000 bolivars of the value manifested or fraction thereof.—Note: 25 bolivars = £1.

UGANDA PROTECTORATE.—The free importation of the following articles has been provided for: Electric cable or wire, the posts for carrying the same, and all other material required for the purposes of generating, storing, or distributing electrical energy, whether for power or lighting, on satisfactory proof being given to the Director of Customs that such articles and materials have been imported solely for such purposes. Such exemption shall not, however, include lamps or their fittings or materials other than industrial machinery required for the purpose of using electrical energy. The above item has been substituted in lieu of the following item, which has now been deleted: Apparatus and appliances used in connection with the generating and storing of electricity, but not including lamp-posts or lamps and their fittings.

SIERRA LEONE.—The Government have instituted a surtax of 25 per cent. on the duty leviable on all goods subject to the *ad valorem* duty of 10 per cent.

FRANCE.—The Government have issued a new decree abrogating the decree of February 12th in virtue of which graphite was allowed to be exported from France without special authorisation when consigned to the United Kingdom, the British Dominions, Colonies and Protectorates, Belgium, Japan, Montenegro, Russia, Serbia, and the United States.

NEW PATENTS APPLIED FOR, 1915.

(NOT YET PUBLISHED).

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

11,790. "Short-circuiting and brush-lifting gear for alternating-current motors." Lancashire Dynamo & Motor Co., Ltd., H. B. Whitmore, and R. J. Roberts. August 16th.

11,795. "Contact devices for ceiling roses, cut-outs, connectors, rosettes and like electrical fittings." H. B. Prentice & W. A. McKerchar. August 16th.

11,818. "Electrolytic refining of tin." W. J. Mellersh-Jackson (American Smelting & Refining Co., United States). August 16th. (Complete.)

11,831. "Transmitters for wireless telephony." Marconi's Wireless Telegraph Co., Ltd., & Soren Oluf Emil Therkelsen Trost. August 16th.

11,889. "Electric or gas light fittings." C. Holly & W. H. Drucquer. August 17th.

11,910. "Accumulator cell boxes for train lighting and other purposes." H. D. Earl. August 18th.

11,935. "Dynamo-electric machine." A. H. Neuland. August 18th. (Complete.)

11,938. "Electric distributing systems for motor road vehicles." H. Lucas and C. L. Breeden. August 18th.

11,957. "Electrical egg-testing devices." H. J. Gentry. August 18th.

11,961. "Method of generating high-frequency electric currents." T. F. Wall. August 19th.

11,974. "Method of and apparatus for controlling dynamo-electric machines or the like for use principally in connection with the lighting and/or heating of trains, motor road, and other vehicles." W. F. W. Rhodes & J. Firth. August 19th.

11,976. "Sound-transmitting means." J. Liddle (Universal High-Power Telephone Co., United States). August 19th. (Complete.)

11,981. "Electrical flasher." W. Reed-Lethbridge. August 19th.

11,990. "Thermostats." W. R. Clark & W. T. Davies. August 19th.

12,000. "Electric supply systems particularly for use with internal-combustion motors." E. C. R. Marks (Motor Ignition & Devices Co., United States). August 19th. (Complete.)

12,039. "Electric signalling apparatus." J. W. Mackenzie (Otto G. H. E. Kehrhahn, United States). August 20th.

12,055. "Sparking plug for internal-combustion engines." R. W. Happe. August 21st.

12,075. "Sealing means, more particularly for use in connection with accumulator cases." C. A. Vandervell. August 21st.

PUBLISHED SPECIFICATIONS.

1914.

3,902. Circuits for Telephone Exchanges. Siemens Bros. & Co., Ltd., E. A. Laidlaw, and W. H. Grinsted. February 14th.

10,110. Gas-detecting Apparatus for Portable Electric Hand Lamps. G. J. Ralph. April 24th. (September 14th, 1914.)

11,940. Electric Signalling Installations. Siemens Bros. & Co., Ltd. (Siemens & Halske Akt. Ges.). May 14th.

11,993. Magnetic Chucks and like Holding Devices. Norma Cie Ges. May 15th. (May 17th, 1913.)

12,018. Subaqueous Sound Signal Receivers. Signal Ges. May 15th. (May 29th, 1913.)

12,210. Enclosed Electric Fuses or Safety Cartridges. Siemens Bros. Dynamo Works, Ltd. (Siemens Schuckertwerke). May 18th.

12,372. Means for Producing High-frequency Currents. P. Dresia. May 19th.

12,443. Insulator for the Overhead Conductors of Electric Lines. F. Libano. May 20th. (May 31st, 1913.)

12,479. Electric Welding. Allgemeine Elektricitäts Ges. May 20th. (May 20th, 1913. Addition to 8,595/14.)

12,682. Electric Switch for Incandescent Lamp Fittings. W. J. Mellersh-Jackson (Geb. Jaeger). May 22nd.

12,814. Slip-rings for Dynamo-electrical Machinery. Siemens Schuckertwerke. May 25th. (May 31st, 1913.)

13,136. Regenerative Braking of Electric Polyphase Commutator Machines. Siemens Schuckertwerke. May 28th. (June 21st, 1913.)

13,213. Tightening Devices for Overhead Electric Conductors. Siemens-Schuckertwerke. May 29th. (May 29th, 1913.)

13,520. Radiating System for Signalling by Electric Waves from Aeroplanes. Signal Ges. June 3rd. (Addition to 736/13 and 23,728/13.)

13,541. Manufacture of Incandescent Lamps. C. Gladitz. June 3rd.

13,553. Vehicle Lighting Plants Working with Dynamo and Storage Battery. Ges. Für Elektrische Zugbeleuchtung. June 3rd. (July 11th, 1913.)

13,554. Vehicle Lighting Plant working with Dynamo and Storage Battery. Ges. Für Elektrische Zugbeleuchtung. June 3rd. (April 28th, 1914. Addition to 13,553/14.)

14,278. Rotors for Dynamo-electric Machinery. Siemens Bros. Dynamo Works, Ltd., & E. O. Kieffer. June 13th.

14,378. Process for Starting Electrically-connected Rotary Converters and Asynchronous Generators. Siemens Bros. Dynamo Works & C. A. B. D. Koettgen. June 15th.

14,379. Implement for Laying Cables or Wires in the Ground. R. H. Fowler (W. Turner). June 15th.

14,381. Rendering Tungsten Ductile. C. Trenzen. June 15th.

14,384. Switching Arrangements for Rotary Converters. Siemens Bros. Dynamo Works, Ltd. (Siemens Schuckertwerke). June 15th.

14,483. Electric Transformers and other High-tension Electric Apparatus Meirowsky & Co. Akt. Ges. & K. Fischer. June 16th.

14,561. Spark Plugs. M. Rall. June 17th. (July 10th, 1913.)

14,683. Tensioning Arrangements for Overhead Electric Conductors. Siemens Schuckertwerke. June 18th. (June 21st, 1913.)

15,024. Receiving Device for Subaqueous Sound Signals. Signal Ges. June 23rd. (July 24th, 1913.)

15,471. Circuit Arrangements for Telephone Systems. Siemens Bros. and Co., Ltd. (Siemens & Halske Akt. Ges.). June 27th.

15,546. Selecting Devices for Telephone or other Circuits. Siemens Bros. & Co., Ltd., T. Pettigrew & D. A. Christian (partly Siemens & Halske Akt. Ges.). June 29th. (Addition to 818/13.)

15,642. Apparatus for the Control or Operation of Railway and the like Points or Switches. Siemens Bros. & Co., Ltd. (Siemens & Halske Akt. Ges.). June 30th.

15,871. Interrupting Devices for High-tension Electric Currents. Siemens Bros. & Co., Ltd. (Siemens & Halske Akt. Ges.). July 2nd.

15,881. Detector for Electro-magnetic Waves. Deutsche Telephonwerke. July 2nd. (January 24th, 1914.)

15,958. Windings of Dynamo-electric Machinery. Siemens Bros. Dynamo Works, Ltd., & E. O. Kieffer. July 3rd.

16,063. Process for the Manufacture of Electrolytic Electrodes. Schott and Gen (firm of). July 6th. (July 21st, 1913. Addition to 17,759/13.)

16,945. Electrometers. B. Szilard. July 16th. (October 15th, 1913. Divided from 20,008/13.)

17,949. Starting Switches or Controllers for Dynamo-electric Machinery. Siemens Schuckertwerke. July 29th. (July 29th, 1913.)

18,033. Telephone Systems. J. G. Blessing. July 30th. (July 31st, 1913.)

18,290. Writing or Copying Telegraph System. A. G. Bloxam (Telepantograph Ges.). August 7th.

18,302. Electric Hoisting Apparatus. A. H. Colley. August 7th.

18,494. Measuring Electrical Energy. J. C. Wilson. August 10th. (August 14th, 1913.)

18,496. Electric Heater Units for Fluid Meters. H. A. Gill (Cutler-Hammer Manufacturing Co.). August 10th.

18,497. Relays for Electric Voltage Regulators. British Thomson-Houston Co., Ltd., A. P. Young, & A. H. St. C. Watson. August 10th.

18,502. Electrical Switches. Siemens Schuckertwerke. August 10th. (November 22nd, 1913.)

18,565. Circuit Arrangements for Operating the Selecting Devices of Telephone Installations by Number Impulses. Siemens Bros. & Co., Ltd., and Pettigrew. August 11th.

18,566. Incandescent Electric Lamps. Allgemeine Elektricitäts Ges. August 11th. (August 18th, 1913.)

18,685. Electric Resistances. British Thomson-Houston Co., Ltd. (General Electric Co.). August 14th.

19,882. Electric Cable. C. J. Beaver & E. A. Claremont. September 7th.

20,603. Attachment to Prevent Theft of Electric Lamps or Globes. H. Maddick. October 6th. (February 19th, 1914.)

21,785. Electric Circuit Breakers. British Thomson-Houston Co., Ltd. (General Electric Co.). October 30th.

22,897. System of Control for Maintaining the Relative Speeds of a Number of Electric Motors. F. C. Anderson & C. A. Atchley. November 23rd. (Cognate application, 6,066/15.)

23,121. Vibrating Rectifiers for Electric Currents. British Thomson-Houston Co., Ltd. (General Electric Co.). November 26th.

23,366. Control System for Electric Motors. Igranic Electric Co., Ltd. (Cutler-Hammer Manufacturing Co.). December 1st.

24,039. Maximum Current or Overload Circuit Breakers. W. J. Mellersh-Jackson (Soc. Anon. Movo). December 14th.

24,429. Binding Posts for Electric Conductors. H. F. Adickes. December 21st.

1915.

1,928. Magnetic Shelf-charging Machines. W. T. Garlitz. February 6th. (February 7th, 1914.)

5,089. Telegraph Key. Sterling Telephone & Electric Co., Ltd., and T. D. Ward-Miller. April 1st.

6,117. Electrical Distribution Apparatus. W. T. Henley's Telegraph Works Co., Ltd., and E. E. Judge. April 23rd.

6,222. Combined Electric Switches and Plug Couplings. G. Markt. April 26th.